OL. XXVIII. — No. 6. JUNE 1951.

# Monthly Bulletin of the International Railway Congress Association

(English Edition)

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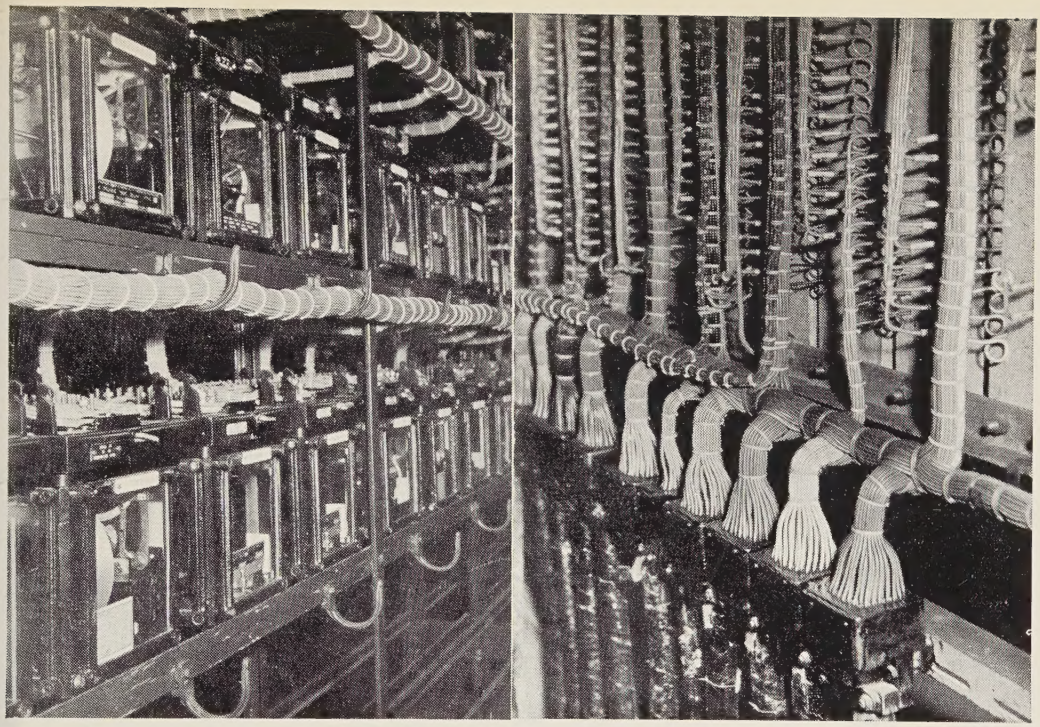

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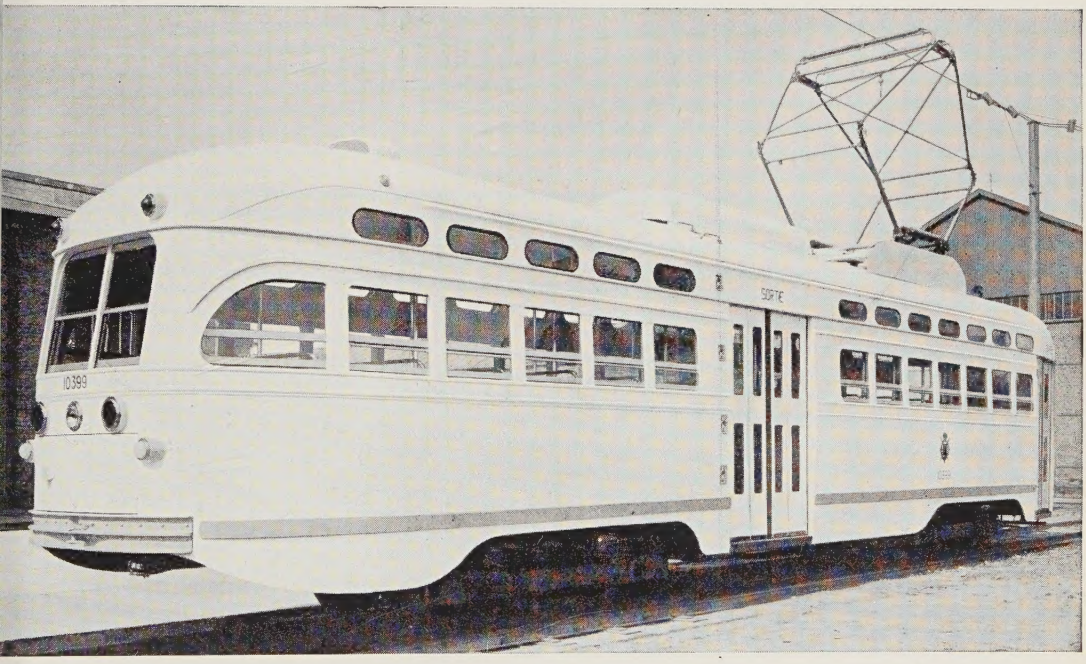


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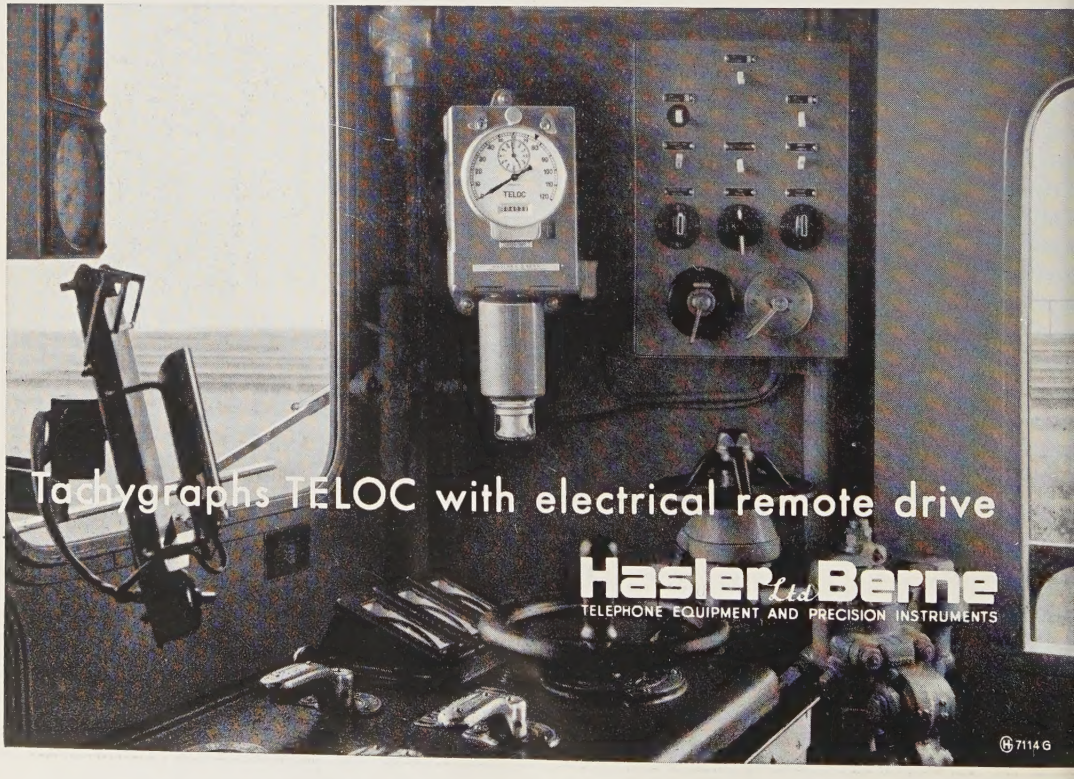


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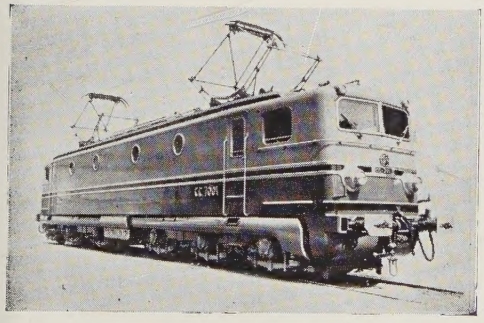

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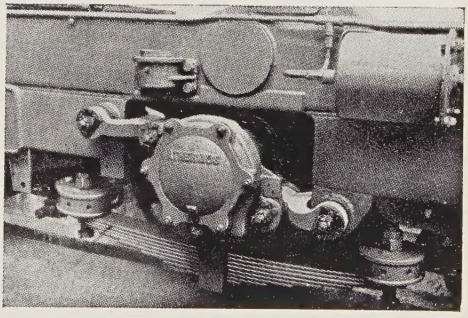

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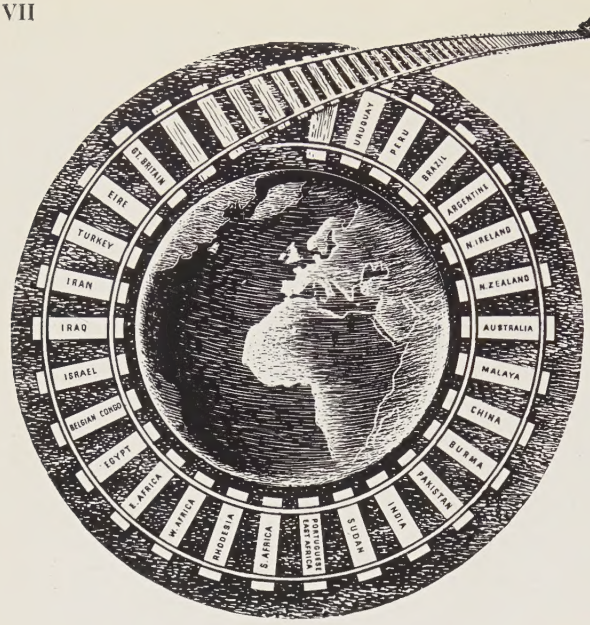


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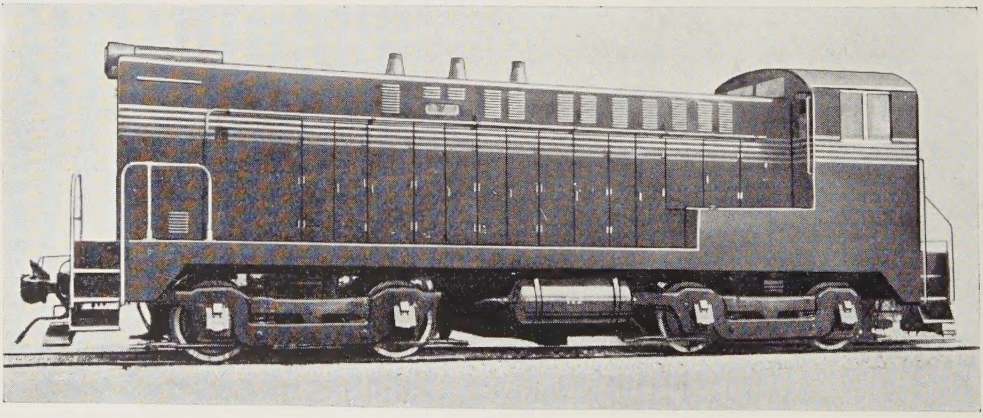

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Bull. of the Int. Ry. Congr. Ass., No. 6, June, p. 327.

**Fifteenth Session, Rome** : 25th September-4th October 1950. — General Proceedings in sections and in plenary meetings (2nd Section : **Locomotives and rolling stock).** (35 000 words.)

**1951** **625** .2

Bull. of the Int. Ry. Congr. Ass., No. 6, June, p. 328.

**The comfort of passengers in coaches, railcars and electric motor coaches** (Question IV, XVth Congress). Discussion. (13 000 words.)

**1951** **621** .135 & **625** .21

Bull. of the Int. Ry. Congr. Ass., No. 6, June, p. 353.

**Improvements in the construction of rolling stock (motor and trailer) in view of increasing the mileage between repairs** (Question V, XVth Congress). Discussion. (12 000 words.)

**1951** **621** .337

Bull. of the Int. Ry. Congr. Ass., No. 6, June, p. 374.

**Comparative study of transmission systems between motors and axles of electric locomotives, electric motor coaches and Diesel-electric railcars. Effect on the track of the types of bogies and systems of motor suspension** (Question VI, XVth Congress). (10 000 words.)

# MONTHLY BULLETIN

OF THE

# INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(ENGLISH EDITION)

PUBLISHING and EDITORIAL OFFICES : 19, RUE DU BEAU-SITE, BRUSSELS

Yearly subscription for 1951 : Belgium . . . . . 700 Belgian Francs
Universal Postal Union. . . 800 Belgian Francs

**Price of this single copy : 80 Belgian Francs (not including postage).**

**Subscriptions and orders for single copies (January 1931 and later editions) to be addressed to the General Secretary, International Railway Congress Association, 19, rue du Beau-Site, Brussels (Belgium).**

Orders for copies previous to January 1931 should be addressed to Messrs. Weissenbruch & Co. Ltd., Printers, 49, rue du Poinçon, Brussels.

**Advertisements** : All communications should be addressed to the Association. **19, rue du Beau-Site, Brussels.**


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An edition in French is also published.

Vol. XXVIII. — No. 6. June 1951.

# BULLETIN
OF THE
# INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[ 385. (06 .112 ]

FIFTEENTH SESSION

**Rome : 25th September-4th October 1950.**

# GENERAL PROCEEDINGS

## 2nd Section : LOCOMOTIVES AND ROLLING STOCK

## INAUGURAL MEETING

**September 26th, 1950, at 9 a. m.**

PRESIDENT : LORD HURCOMB,
MEMBER OF THE PERMANENT COMMISSION OF THE ASSOCIATION.

— The Meeting opened at 9 a.m.

**The President.** — Gentlemen, the Permanent Commission of the Association requested me to preside over the works of the 2nd Section. *(Applause.)*

We will start by making up the Bureau of the Section and I suggest the election as *Vice-Presidents* of :

Mr. F. TURELL, Under Secretary of Public Works, Spain, and

Mr. S. GIALISTRAS, General Manager of the Hellenic State Railways,

and as *Principal Secretary :*

Mr. UYTBORCK, Engineer, Belgian National Railways.

*(Marks of approval and applause.)*

— The Section on the President's proposal subsequently completed its Bureau and drew up a provisional agenda.

## QUESTION IV.

## The comfort of passengers in coaches, railcars and electr motor coaches :

**Sound proofing;**
**Lighting;**
**Heating, air conditioning, ventilation, thermic isolation;**
**Upholstery;**
**Running stability (type of bogie and suspension),**

### Preliminary documents.

Report (Belgium and Colony, Denmark, France and Colonies, Luxemburg, Netherlands and Colonies, Norway, Poland, Switzerland and Syria), by O. G. WEBERG. (See *Bulletin*, May, 1950, p. 931, separate issue No. 20.)

Supplement to Report by O. WEBERG. (See *Bulletin*, September 1950, p. 1995.)

Report (America (North and South), Burma, China, Egypt, Great Britain and North Ireland, Dominions, Protectorates and Colonies, India, Iran, Iraq, Mal States and Pakistan), by E. F. LOQUE (See *Bulletin*, July 1950, p. 1597, separa issue No. 33.)

Report (Austria, Bulgaria, Czech slovakia, Finland, Greece, Hungary, Ital Portugal and Colonies, Rumania, Spai Sweden, Turkey and Yugoslavia), M. MARTINELLI. (See *Bulletin*, Septemb 1950, p. 1861, separate issue No. 3

*Special Reporter :* M. MARTINELLI. (S *Bulletin*, October 1950, p. 2042.)

# DISCUSSION BY THE SECTION.

## Meeting held on the 26th September 1950.

UNDER THE PRESIDENCY OF LORD HURCOMB.

— The Meeting began at 9.10 a.m.

**The President.** — Gentlemen, the first question on our aggenda is Question IV : *The comfort of passengers in coaches, railcars and electric motor coaches :* sound proofing; lighting; heating; air conditionning, ventilation; thermic insulati upholstery; running stability (type bogie and suspension).

Will Mr. MARTINELLI, *Special Repor* please be good enough to read the su maries from his special report.

**Mr. Martinelli** (in French). — We begin with *Chapter A : Sound insulation.*

*Summary No. 1 :*

1. The experiments carried out by different railways prove that elastic wheels do not lead to any appreciable improvements from the point of view of the sound insulation of vehicles. Such types of wheels can even be the source of parasitic vibrations in themselves.

**The President**. — Has anyone anything to say about this first summary?

**Mr. Chan**, *French National Railways* (in French). — Does this summary cover all vehicles, coaches or railcars, including light weight stock, or only heavy vehicles?

In France, we have had some experience of elastic wheels on light 150 HP railcars. The first results were favourable from the point of view of comfort, running over joints, and consequently from the point of view of reducing the noise.

I would like to know if this summary also includes very light vehicles.

**Mr. Martinelli**. — I stated in the first part of my report that elastic wheels could give good results from the point of view of decreasing the stresses in the parts, but do not give very remarkable results as regards the reduction of noise, especially in the case of high speed vehicles.

In the case of vehicles running at low speeds, such as urban tramways, excellent results can be obtained, but in the case of railways with high speed vehicles, the Administrations reported that the results obtained from the point of view of sound deadening were not very remarkable.

Trials have however been continued in order to decrease the strains and stresses. Reduced speeds and small loads per axle give good results, without resulting in too great thermic or mechanical stresses for the rubber.

**Mr. Chan.** — These results agree with our experiences, which only concern very light weight vehicles, running at relatively low speeds. I am in agreement therefore with the Reporter.

Could not this summary be completed by making it clear that the use of elastic wheels on fast vehicles of a heavy type will not result in any appreciable improvement, leaving the way open for other summaries to deal with light vehicles?

**The President.** — Does anyone else wish to raise any point in connection with this summary?

**Mr. Uytborck**, *Principal Secretary* (in French). — In this case, the summary will have to be modified.

Do you agree, Monsieur Martinelli?

**Mr. Martinelli.** — Yes. The summary in its present form was based on the replies received. About 50 % of the Administrations consulted replied to my questionnaire and reported that from the point of view of sound deadening, no great advantages had been obtained. I could not base my summaries on replies I did not receive.

**The President.** — Does any other member of this Section wish to express an opinion on this question?

**Mr. Loquet**, *Reporter* (in French). — I think that M. MARTINELLI's summary was based to a great extent on the first few lines of my report regarding the use of elastic wheels on the underground stock of the London Transport Executive, where the operating conditions are just about as bad as possible. It is a question in this case of stock operated in tunnels, i. e. stock reaching relatively high speeds, and braked very frequently, with a very pronounced braking effort between the different stops. The London Transport Executive reported that elastic wheels were of no interest to them, neither from the point of view of noise, nor from the point of view of current operation.

**Mr. Martinelli.** — It was not only the London Transport Executive who replied on these lines, but also other Administrations.

The Italian Railways also carried out trials of elastic wheels. The results obtained from the point of view of sound insulation were not only not excellent, they were not even good.

**The President.** — Does anyone else wish to express an opinion on this subject?

Does no one apart from Mr. CHAN wish to make an addition to this summary explaining that it refers mainly to fast stock and heavy stock?

If Mr. CHAN is the only one who wants such an alteration to be made, we will have to keep the wording as it is.

**Mr. Chan.** — In view of the general agreement, I will not insist upon it. To my way of thinking, it was merely a matter of leaving the way open as regards its application to small vehicles, but if it is strictly limited to sound proofing without mentioning the other advantages, I will not insist on it.

**The President.** — Gentlemen, are you agreed concerning the wording of summary 1 as proposed by the Special Reporter? *(Agreed.)*

— *Summary 1 was adopted without change.*

**Mr. Martinelli.** — *Summary 2 :*

2. It is possible to reduce the formation of noise by :

— simplifying the brake rigging and doing away with a central rigging;

— providing suitable guides for all the moveable parts of the body;

— covering the body sheets with absorbant substances and reducing the size (area) of sheets used;

— using helicoidal gears in the drive of railcars and ground gears for rail motor coaches.

**The President.** — No comments?

**Mr. Hug**, *Bernese Alps Railways, Switzerland.* — I think there is one point of view that has not been mentioned in the different reports, although it is very important as regards reducing the noise. This is the use of light alloys to replace steel in the construction of the bodies of vehicles. I have had some experience of this, especially on mountain lines where it applies more directly, and I have found that vehicles made of light alloys, in the construction of which use is made of aluminium alloys, are much less sonorous than those built of welded sheet steel.

Experience in this field is still limited. There are however vehicles of this kind in different countries, and in particular in England, where the London Transport Executive, if I am not mistaken, has 90 such vehicles — partly in service and partly under construction — one of the reasons for using light alloys being the better sound proofing, especially in tunnels.

**Mr. Martinelli.** — I did not receive any information about this method of obtaining a reduction in the noise.

**Mr. Uytborck.** — In Summary 2 : « It is possible to reduce the formation of noise... » would you agree to adding « by using light alloys in the construction of vehicles » ?

**Mr. Loquet.** — It would be necessary to add « especially for the bodies of vehicles » as this is what Mr. Hug meant. *(Mr. Hug made a sign of agreement.)*

Light alloys are already frequently used for the interior lining, and I do not think they lead to any appreciable reduction of noise inside the body, but Mr. Hug's remark is to the point. However the English Administrations, who replied to the questionnaire, did not mention this point, no doubt because this stock was not yet in service but only under construction.

**Mr. Martinelli.** — The Meeting should be asked to express an opinion regarding the inclusion of this method of sound insulation in the Summary.

**Mr. Uytborck.** — Did you not have any replies about this point?

**Mr. Martinelli.** — I did not get such information from anyone.

**The President.** — Does anyone else besides Mr. Hug want this Summary to be altered?

**Mr. Cuttica,** *Italian State Railways* (in French). — As Mr. Hug's remark is the only statement to this effect, it might be pointed out to the Administrations in the Summary that the use of aluminium in the bodies may result in advantages from the point of view of sound deadening, without any definite statement as to the results that can be expected therefrom.

**The President.** — Does everyone agree?

**Mr. Loquet.** — I think, on the contrary, the reduction in noise due to the use of light alloys in the body is very remarkable, and the Summary can be taken as definitive.

**Mr. Uytborck.** — Why was no mention at all made of this point in the reports?

**Mr. Loquet.** — Because the material was not yet in service. Trials are being carried out everywhere and the first results obtained led us to conclude that the reduction in noise due to the use of light alloys, especially in the bodies, is considerable. I have some actual personal experience of light alloy vehicles, and the reduction in noise, the resonance of the sheets, etc., is remarkable.

**The President.** — Could we take these actual results into account and therefore state that the question will be gone into at a later date? *(Agreed.)*

Is everyone agreed about Summary 2. *(Agreed.)*

*— Summary 2 was adopted in its original form.*

**Mr. Martinelli.** — *Summary 3 :*

3. The use of anti-vibration packings between body and bogie is very widespread. The S. N. C. F. doubt their utility however.

**Mr. Parmantier**, *French National Railways* (in French). — Mr. President, as representative of the S. N. C. F., I want to ask you to delete the phrase : « The S. N. C. F. doubt their utility however ». This was mentioned by mistake in the reply supplied by the S. N. C. F. It is just a matter of correcting this reply.

**Mr. Martinelli.** — I see no objection to deleting this phrase, although the S. N. C. F. did reply on these lines.

**The President.** — Is everyone agreed about the suppression of this phrase?

**Mr. Parmantier.** — The S. N. C. F. suggest it; they are merely correcting what they said.

**Mr. Uytborck.** — It only concerns them.

**The President.** — Does everyone agree about suppressing this last line, so that Summary 3 will read :

« 3. The use of anti-vibration packings between body and bogie is very widespread. »

*(Agreed.)*

*— Summary 3 was adopted in this modified form.*

**Mr. Martinelli.** — *Summary 4 :*

4. The suspension of the heat engines is always completed by very elastic rubber packings.

**The President.** — No remarks?

*— Summary 4 was adopted.*

**Mr. Martinelli.** — *Summary 5 :*

5. In the construction of up-to-date rolling stock, extensive use is made of absorbant substances on the walls, floors, ceilings and doors.

Such substances provide satisfactory heat insulation. The latter is completed, in very cold countries, by the use of double windows.

**The President.** — No remarks?

*— Summary 5 was adopted.*

**Mr. Martinelli.** — *Summary 6 :*

6. There is a tendency to equip railcars with a platform or luggage compartment between the compartments and the driving compartment.

**The President.** — No remarks?

*— Summary 6 was adopted.*

**Mr. Martinelli.** — *Summary 7 :*

7. The transmission of noise can be reduced by carefully packing the trap-doors in the floors and the holes for the pipes and conduits.

**The President.** — No remarks?

— *Summary 7 was adopted.*

**Mr. Martinelli.** — This brings us to *Chapter B : Lighting.*

*Summary 1 :*

1. Up to the present incandescent lamps have been widely used. Fluorescent lighting is now developing very rapidly.

**The President.** — Has anyone anything to say?

— *Summary 1 was adopted.*

**Mr. Martinelli.** — *Summary 2 :*

2. At the present time the filaments of incandescent lamps are screened by using either opaque bulbs or opaline diffusers.

**The President.** — No remarks?

— *Summary 2 was adopted.*

**Mr. Martinelli.** — *Summary 3 :*

3. For some years there has been an appreciable increase in the amount of light provided (90 lux in 1st and 2nd classes; 50 lux in 3rd class at reading level). With equal power installed, the lighting can be tripled approximately by the use of fluorescent tubes.

**The President.** — Are we agreed about this?

**Mr. de Sousa,** *Railway Board, India.* — In India, we have just started an experiment with fluorescent lighting, and our experience so far is not too good. I would like to know who has tried fluorescent lighting in the different countries, and whether they have found it successful everywhere. This is because the first trial coach we had so fitted in India was not a success. I would like to know the results of trials in other countries and whether the lighting in question can be used generally.

**Mr. Martinelli.** — I should like to know exactly from what point of view these trials proved unsuccessful.

**The President.** — Will Mr. de Sousa please obtain the details he wants directly from other Administrations.

Gentlemen, are we agreed as to the text of Summary 3? *(Agreed.)*

— *Summary 3 was adopted without alteration.*

**Mr. Martinelli.** — This brings us to *Chapter C : Heating. — Air conditioning. Ventilation. — Heat insulation.*

*Summary 1 :*

1. With steam heating, there is a general tendency to increase the feed pressure in the main steam pipe in order to improve the heating of the last few vehicles of the train.

**The President.** — No remarks?

— *Summary 1 was adopted.*

**Mr. Martinelli.** — *Summary 2 :*

2. In the corridors of compartment coaches, the steam or electric radiators are arranged either against the body sides or against the compartment partitions, or in the compartments themselves. Some railways use the actual steam conduit as a radiator for heating the corridors.

**The President.** — No remarks?

— *Summary 2 is adopted.*

**Mr. Martinelli.** — *Summary 3 :*

3. Direct electric heating by radiators is the most widely used and most economical method. It gives satisfactory results provided the circulation of air around the heating elements is adequate.

**The President.** — Any comments?

— *Summary 3 is adopted.*

**Mr. Martinelli.** — *Summary 4 :*

4. Pulsated air electric heating increases the comfort, and also makes it possible to ventilate the vehicles during the summer. However, the consumption of current in high and low tension is much higher than with direct heating.

**The President.** — Are there any comments?

**Mr. Parmantier.** — Mr. President, if the second sentence : « However the consumption of current in high and low tension is much higher than with direct heating » is accurate, I should like to know the reason for this.

**Mr. d'Arbela**, *Italian State Railways* (in French). — I think that the statement that the consumption of current is higher in the case of pulsated air heating is explained by the fact that with this method of heating the air is constantly being renewed and the hot air discharged to the atmosphere. The renewal of the air consequently involves a higher current consumption. I think the difference is due solely to this circumstance.

**Mr. Martinelli.** — There is also some loss of heat in the ventilation ducts.

**The President.** — Are there no further comments on this point?

Are you agreed that the Summary should be left unchanged?

**Mr. Martinelli.** — Yes, I think it should be maintained as it is. I am of the opinion that the consumption of low tension current is much greater. In the case of high tension current, there is not much difference, especially when the advantages obtained by renewing the air are remembered. Such advantages have to be paid for. There are some losses in the ventilation ducts; there is no disputing the fact.

**Mr. Uytborck.** — I think that under these conditions, the Summary can be left as it is. *(Agreed.)*

— *Summary 4 was adopted in its original form.*

**Mr. Martinelli.** — *Summary 5 :*

5. The compartments are generally heated individually, with thermostatic control.

**The President.** — Does everyone agree to this wording?

**Mr. Parmantier.** — Mr. President, may I ask a question. The French Railways have not always a thermostat per compartiment. I would like to know if other Administrations regulate the heat by a thermostat in each compartment.

**Mr. Martinelli.** — In general, the others use one thermostat. I stated moreover in my summary « generally ».

**Mr. d'Arbela.** — The Italian State Railways adopted the practice of regulating the heat per coach in a first series of vehicles. However, as the Special Reporter stated in his Summary 5, there is this tendency. In the case of the new coaches in the international services, the heat can be regulated in each compartment. This answers the remark made.

**The President.** — I suggest we retain the French text and make the English text, which does not include the word « tendency », agree with the French.

Do you agree? *(Agreed.)*

*— The French text of Summary 5 was adopted, and the English text slightly altered to correspond exactly with the French.*

**Mr. Martinelli.** — *Summary 6 :*

6. In railcars, heating by the engine cooling water or exhaust gases does not usually give sufficient comfort. On both vehicles and trailers the present tendency is towards the use of coal or oil systems of heating. In the latter case, the working can easily be made automatic.

**The President.** — No remarks?

*— Summary 6 was adopted.*

**Mr. Martinelli.** — *Summary 7 :*

7. Coaches not equipped with air conditioning or pulsated air heating are nearly always equipped with ventilators in the ceilings or walls. A few applications of forced ventilation have also been carried out.

**The President.** — Are you agreed about this text? *(Agreed.)*

*— Summary 7 was adopted.*

**Mr. Martinelli.** — *Summary 8 :*

8. Air conditioning is in general use in the U. S. A. and in tropical countries. In Europe, it has only been tried to a very limited extent.

**The President.** — No remarks?

*— Summary 8 was adopted.*

**Mr. Martinelli.** — *Summary 9 :*

9. In coaches equipped with air conditioning with cooling equipment, use is always made of double fixed windows.

**The President.** — Does everyone agree?

*— Summary 9 was adopted.*

**Mr. Martinelli.** — This brings us to *Chapter D : Fittings.*

*Summary 1 :*

1. In coaches of European construction, the seats always face each other, whilst in America, Australia and Africa they often face in the same direction, and can generally be reversed and have adjustable backs.

**The President.** — Are there any remarks?

**Mr. Parmantier.** — Regarding the first point, the French Railways at the present time have two coaches under trial with adjustable and reversible seats, which we have imported from America.

**Mr. Chan.** — I may mention in addition as an example of coaches in service in Europe with adjustable seats the Spanish Talgo train.

**Mr. Martinelli.** — In Europe, there are some examples of seats of the American type, all facing the same way. I said « generally » in my summary.

**Mr. Parmantier.** — I think this may be taken as a tendency. It is a question of deciding if at the present time it should be stated that there is a tendency in Europe to adopt the American type of construction.

**Mr. Martinelli.** — I concluded from the information sent in that seats all facing in the same direction are only in service in Europe in the case of coaches imported from America, and such coaches are only few in number.

**Mr. Uytborck.** — I think that in reality it is a question of increasing the comfort and the Americans are more advanced than we are in this respect. In fact, in a few years time adjustable and reversible seats will also be found in service in Europe if the trials now in hand prove satisfactory.

**Mr. Parmantier.** — I think that without mentioning France we might say that trials have been made of reversible and adjustable seats in Europe.

**Mr. Uytborck.** — Are there no reversible seats in France?

**Mr. Parmantier.** — Yes, they are also reversible, adjustable and reversible, so that at each end of the run, and when there is a change of direction, the seats can be reversed.

**Mr. d'Arbela.** — It might be pointed out that the use of seats facing in one direction only rather depends upon the frequency of terminus stations, i. e. stations at which the train changes its direction. The use of reversible seats does not completely overcome the inconvenience due to the fact that at a terminus station the direction of all the seats has to be changed if passengers are to continue facing the same direction.

**The President.** — Are there no other remarks about this Summary?

**Mr. Parmantier.** — I think it would be sufficient to report that trials have been carried out in Europe of a few coaches with adjustable and reversible seats.

**The President.** — Does the Special Reporter agree?

**Mr. Martinelli.** — Yes.

**Mr. Uytborck.** — Does everyone agree that the following words should be added to Summary 1 :

« It may however be noted that trials are being undertaken in Europe with adjustable and reversible seats. »

*(Agreed.)*

**The President.** — *Summary 1* will therefore read :

« 1. In coaches of European construction, the seats always face each other, whilst in America, Australia and Africa they often face in the same direction, and can generally be reversed and have adjustable backs. It may, however

be noted that trials are being undertaken in Europe with adjustable and reversible seats. »

Are you agreed about this text? *(Agreed.)*

*— Summary 1 modified in this way was adopted.*

**Mr. Martinelli.** — *Summary 2 :*

2. In Europe, springs and hair are used to upholster the seats. In America, Australia and Africa, sponge rubber is also used.

**The President.** — No remarks?

*— Summary 2 was adopted.*

**Mr. Martinelli.** — *Summary 3 :*

3. The use of leather or similar synthetic products has been greatly extended for seat coverings, except in cold countries and in Europe, where textile materials are still widely used.

**The President.** — Are there any comments?

**Mr. Parmantier.** — Mr. President, I would like to point out that this Summary does not perhaps reflect what is actually being done, i. e. the use in European countries of textile materials or moquette in 1st and 2nd classes, and synthetic products in the thirds.

**Mr. Martinelli.** — This Summary refers above all to 1st and 2nd classes coaches, but a sentence may be added about 3rd class carriages.

**Mr. Parmantier.** — Yes, perhaps.

**Mr. Uytborck.** — How would you suggest wording it Mr. MARTINELLI?

**Mr. Parmantier.** — What about saying: « ... where particularly in the 1st and 2nd classes, textile materials are still widely used »?

**Mr. Martinelli.** — Leather and synthetic products are in universal use in the thirds.

**Mr. Parmantier.** — I suggest to say : « ... except in cold countries and in Europe, where, particularly in 1st and 2nd classes carriages, textile materials are still widely used ».

**Mr. Martinelli.** — That would meet the case.

**The President.** — In England, textile materials are also used in the thirds. We might alter the suggested wording a little therefore, and re-examine it.

**Mr. Martinelli.** — We might say : « ... except in cold countries and in Europe where textile materials are still used, especially in 1st and 2nd classes ».

**The President.** — Yes, something of the sort.

The wording will therefore be :

« 3. The use of leather or similar synthetic products has been greatly extended for seat coverings, except in cold countries and in Europe, where, particularly in 1st and 2nd classes, textile materials are still widely used. »

Agreed? *(Agreed.)*

*— Summary 3 modified in this way was adopted.*

**Mr. Martinelli.** — *Summary 4 :*

4. Head and arm rests are still used in 1st and 2nd classes.

**The President.** — Are there any remarks?

**Mr. Parmantier.** — There is a tendency however in certain countries to give a certain amount of comfort in the thirds. I think this should not be overlooked in this Summary.

In France, we are of the opinion that 3rd class passengers should be given a certain amount of comfort, if we wish to retain our customers.

**Mr. Martinelli.** — I pointed this out in the report.

**Mr. Parmantier.** — Yes, but not in the Summary.

**Mr. Martinelli.** — In order to be as brief as possible.

**Mr. Parmantier.** — It is however extended to the thirds.

**Mr. Martinelli.** — Yes, it should be mentioned.

**Mr. Uytborck.** — Is there a tendency to do so in the thirds?

**Mr. Parmantier.** — It is more than a tendency; it is actually done.

**Mr. Martinelli.** — We might say : « Head and arm rests are still used in 1st and 2nd classes, and they are also used in 3rd class carriages intended for longs runs ».

**Mr. Parmantier.** — Agreed.

**The President.** — In certain countries, they are also used in the thirds. Is this what you actually wish to state? It would be better then to say they are always used; they tend to be used more generally. I think we should say : « and are increasingly being used in 3rd class carriages in certain countries ». This would be more accurate.

**Mr. Parmantier.** — Agreed.

**The President.** — Does the Meeting agree to this modification? *(Agreed.)*

*— Summary 4 was therefore modified as follows :*

« 4. Head and arm rests are still used in 1st and 2nd classes and also in 3rd class in certain countries. »

**Mr. Martinelli.** — *Summary 5 :*

5. There is a definite tendency to provide upholstered seats in 3rd class, as well as seats that can be turned into berths on coaches making long runs.

**The President.** — No remarks?

*— Summary 5 was adopted.*

**Mr. Martinelli.** — *Summary 6 :*

6. The centre corridor is almost general practice in the case of stopping train coaches, and also for railcars and rail motor coaches.

**The President.** — Are there any remarks?

**Mr. Pugson,** *British Railways.* — As regards a central corridor being the general practice on coaches for stopping trains, I would like to point out that this cannot be said to be true of the British Railways where it is the practice to use stock with central corridors and also non-corridor stock.

**The President.** — Could Mr. PUGSON suggest the actual wording for the alteration he wishes to make to this Summary?

**Mr. Pugson.** — I suggest adding : « Except on the British Railways where the practice is to use stock with central corridor and also non-corridor stock ».

**Mr. d'Arbela.** — For the stopping trains?

**The President.** — Yes.

**Mr. d'Arbela.** — Consequently, it refers to « stopping trains ».

**Mr. Martinelli.** — In Summary 7, it is only question of main line stock. Summary 6 says : « The centre corridor is almost general practice in the case of stopping train coaches... ».

**Mr. d'Arbela.** — Mr. PUGSON suggests the alteration in the case of Summary 6.

**Mr. Martinelli.** — It must therefore be stated that coaches with a side corridor are used.

**Mr. Pugson.** — On the British Railways, there are consequently both corridor and non-corridor coaches on the stopping trains.

**Mr. Martinelli.** — But is there a tendency to use coaches with a centre or a side corridor?

**The President.** — England is an exception to the rule.

**Mr. Martinelli.** — In Italy, side corridor coaches are also used on the stopping trains, but there is no tendency.

**The President.** — Will Mr. PUGSON please come to an agreement with Mr. MARTINELLI regarding the wording of this Summary, so that the new text can be submitted to the Meeting to-morrow. *(Agreed to by Mr. Pugson.)*

*— Summary 6 was therefore left over till to-morrow.*

**Mr. Martinelli.** — *Summary 7 :*

7. In Europe the main line stock often has a side corridor, whilst in America, the centre corridor is the most common.

**The President.** — Do you agree to this wording Mr. PUGSON?

**Mr. Pugson.** — Yes.

**The President.** — Are there any remarks about Summary 7?

*— Summary 7 was adopted.*

**Mr. Martinelli.** — *Summary 8 :*

8. In Europe, there are 3 seats a side in 1st class, 4 and sometimes 5 in 3rd class. There are 3 or 4 seats a side in 2nd class.

**The President.** — No remarks?

*— Summary 8 was adopted.*

**Mr. Martinelli.** — *Summary 9 :*

9. On railcars and rail motor coaches, and on all the American coaches, there are 4 seats a side.

**Mr. Cuttica.** — I suggest adding the word « generally », because we are now providing 3 seats, even on the railcars.

**Mr. Martinelli.** — I see no objection, but it should not be forgotten that my report refers to replies received in October of last year.

**Mr. Uytborck.** — That is no reason; the summaries should be brought up to date.

**The President.** — Do you agree to the addition of the words « in general » Mr. UYTBORCK? Summary 9 would then read :

« In general, in railcars and rail motor coaches, and in all American coaches, there are four seats a side. »

**Mr. Parmantier.** — I quite agree to the meaning, but from the point of view of the text I think it would be better to say : « there are generally four seats across ».

**Mr. Uytborck.** — Then it would refer to the American coaches as well.

**M. Parmantier.** — If you said : « In rail motor coaches and railcars in general... » the wording is not very clear. If you want a precise text, it would...

**Mr. Uytborck.** — The sentence wants to be turned round, saying : « In all American coaches and, in general, in railcars and rail motor coaches... ».

**Mr. Parmantier.** — That is right, I quite agree.

**The President.** — Does everyone agree to the following wording :

« 9. In all American coaches and in general in railcars and in rail motor coaches, there are 4 seats a side. »

*(Agreed.)*

— *Summary 9, modified in this way, was adopted.*

**Mr. Martinelli.** — *Summary 10 :*

10. Plywood or composition material (Masonite) is widely used to cover the walls. Special coverings of plastic materials are also being used.

**The President.** — No remarks?

— *Summary 10 was adopted.*

**Mr. Martinelli.** — *Summary 11 :*

11. The floors are generally covered with linoleum, and more rarely rubber. These materials are sometimes covered by a carpet in 1st class.

**The President.** — Does everyone agree to this wording?

**Mr. Parmantier.** — Mr. President, I want to ask a question.

This Summary refers to main line coaches. The floors of suburban coaches are not always covered with linoleum, at least in France, cement base coverings also being used.

**Mr. Martinelli.** — I think however that the Summary is a fair report of the reply received from the French Railways.

**Mr. Parmantier.** — Possibly.

**Mr. Martinelli.** — We must ask Mr. WEBERG.

**Mr. Parmantier.** — I quite agree to the wording.

**Mr. Martinelli.** — I do not think the use of magnesium cement constitutes a tendency.

**Mr. Parmantier.** — I am of the opinion that this method is entirely satisfactory provided good quality materials are used.

I agree to the proposed text however.

**The President.** — Are we all agreed? *(Agreed.)*

— *Summary 11 was adopted without alteration.*

**Mr. Martinelli.** — *Summary 12 :*

12. The walls of W.C.s are covered with painted, enamelled or vitrified sheets. There are also some examples of rustless steel being used, or plywood covered with plastic materials.

**The President.** — No comments?

— *Summary 12 was adopted.*

**Mr. Martinelli.** — *Summary 13 :*

13. The floors of W.C.s are in mosaic or earthenware tiles, in rubber with coverings, special asphalt or cement, or metal grills.

**The President.** — Does this text correspond to the general practice. No comments?

— *Summary 13 was adopted.*

**Mr. Martinelli.** — *Summary 14 :*

14. Hot water for washbasins in the W.C.s is beginning to be provided more generally, especially during the winter.

**The President.** — Do you agree to the text of Summary 14?

**Mr. Cuttica.** — May it be asked if there are any Administrations who are considering the provision of hot water, even in the case of electrically heated coaches, or simply in the case of those heated by steam?

**Mr. Uytborck.** — I can answer your question as far as Belgium is concerned. We are making provision for heating the water to prevent it freezing — not for the comfort of the passengers — on the international coaches now under construction.

**Mr. Cuttica.** — Even with electric heating? This is the point in which I am interested.

**Mr. Uytborck.** — I am speaking of the latest international coaches under construction, with combined steam-electric heating at three voltages, but water is not used in the winter on the coaches used for internal services.

**The President.** — Are we agreed to keep the Special Reporter's Summary as it is? *(Agreed.)*

— *Summary 14 was adopted.*

**Mr. Martinelli.** — We now come to *Chapter E : Stability of running.*

*Summary 1 :*

1. Most Administrations continue to use the classic types of bogies on their up-to-date stock as previously standardised.

**The President.** — Are there any comments about this text? It is a very important question; perhaps we could examine Summaries 1 and 2 together. Will Mr. MARTINELLI read also the Summary 2.

**Mr. Martinelli.** — *Summary 2 :*

2. Such bogies can be used at high speeds provided special care is taken in the maintenance of the stock and permanent way.

**The President.** — Does anyone wish to say anything?

**Mr. Parmantier.** — However, the new bogies put into service must not lead to important additional costs in maintaining the stock and permanent way.

**Mr. Martinelli.** — By « high speeds » I mean speeds of 150 km (93 miles) and over.

**The President.** — Has anyone any opinion to give on this point or any information to supply?

**Mr. Uytborck.** — We could put « very high ».

**Mr. Parmantier.** — I am afraid we will be blamed for introducing very high speeds involving very high permanent way costs. What we should try to build is stock which damages the permanent way as little as possible.

**Mr. Martinelli.** — It is not a question of the cost in this case, but simply of special maintenance conditions, i. e. the permanent way must be kept in a very good state of maintenance.

**Mr. Parmantier.** — But maintenance costs money.

**Mr. d'Arbela.** — We might reword the Summary to make it clear that it is not the bogies which damage the permanent way, but that in order to run the usual types of bogies at such speeds, it is necessary to have a particularly high degree of maintenance of the permanent way.

This would bring out the possibilitities of such stock, but only in the case of particularly good permanent way. This would not mean that there would be higher costs. We are merely saying that it is possible to run them under such conditions, but not if the condition of the permanent way is unsatisfactory.

**Mr. Martinelli.** — That is the meaning of Summary 2. I think that the word « provided » has this meaning.

**The President.** — What does the Special Reporter think of the last remark?

**Mr. Martinelli.** — I think that the exact meaning of Summary 2 is precisely that given by Mr. D'ARBELA, but I also think that the word « provided » makes its meaning quite clear.

No mention is made of damaging or spoiling the permanent way, but it is simply stated that in order to run the classic types of bogies at very high speeds, special conditions are involved as regards the stock and permanent way.

**The President.** — Do Messrs. D'ARBELA and PUGSON wish to keep the text as it is?

**Mr. d'Arbela.** — I do not think it is necessary to alter it.

**Mr. Pugson.** — We find the Summary satisfactory.

**Mr. Chan.** — I would like to ask a question. If there were only bogies running at 130 km (80 miles)/h, and if there were no locomotive at the head, do you think the permanent way would need special maintenance? In other words, this Summary might give the impression that the need for maintaining the permanent way is on account of the bogies. But it is not only the bogies of the coaches that run over it; there are also the locomotives.

Was it not the locomotives which led the Special Reporter to conclude that the permanent way must be satisfactorily maintained? I quite agree that the bogie itself, at 130 or 150 km (80-93 miles)/h must be carefully checked from the point of view of play, from the point of view of the rolling stock. If we want to run bogies at 150 km/h, the play must be taken up more often. But is the maintenance of the permanent way necessitated by this bogie? If the bogie is well maintained and if the permanent way is not damaged by the locomotives, is any special maintenance of the permanent way involved?

I am afraid we are drawing attention to the cost of the permanent way, which is attributable to the locomotives, to the traction stock rather than to the bogies.

**The President.** — Is this point not covered by the wording of the Summary which says : « ... provided special care is taken in the maintenance of the stock and permanent way »?

**Mr. Chan.** — Yes, I quite agree as far as the special maintenance of the bogies is concerned. I recognise the fact that the bogies must be maintained just as the locomotives must be maintained. The word « stock » meaning the bogies seems to be accurate. The bogies must be maintained, but I wonder if it is necessary to speak of the cost of the permanent way in connection with the speed of the bogies, as though the expenditure on the permanent way was caused by such bogies running at high speeds. There are two points of view.

**Mr. Martinelli.** — In order to prevent any wrong interpretation being put on this Summary, I think it should be modified, and read : « These bogies ride sufficiently comfortably, even at very high speeds, if the maintenance of the stock and permanent way are sufficiently good. » I might even say « are particularly good » or « provided the maintenance of the stock and permanent way is particularly good ».

**Mr. Parmantier.** — « Particularly good » is perhaps a little exaggerated.

**Mr. Martinelli.** — Perhaps in France.

**The President.** — This is an important Summary. Would it not be better if the proposed text was distributed and submitted to the Section to-morrow? Are we all agreed that an amended text is needed?

**Mr. Martinelli.** — Yes.

**Mr. Loquet.** — Mr. President, I think that when Summary 3 of Mr. MARTINELLI's report has been read, the doubts of the French delegates will be dissipated. There mention is made of improvements in the suspension and in the maintenance of bogies, and I do not think it is necessary to alter Summary 2.

**The President.** — Possibly so, but are we not going to modify the wording of Summary 2? *(Agreed by the French delegates.)*

Are we agreed about the text of Summary 1? *(Agreed.)*

— *Summary 1 was adopted.*

**The President.** — The text of Summary 2 is held over.

**Mr. Martinelli.** — *Summary 3 :*

3. Bogies of special types for ordinary and high speeds have recently been tried and seem likely to be generally used on the future rolling stock of some railways. However, in the design of bogies other factors than the comfort must also be taken into account (cost, weight, ease of maintenance).

**The President.** — Has Mr. LOQUET of the Belgian Railways any objections?

**Mr. Loquet.** — No, I am in complete agreement with the text given in the report.

**The President.** — Has Mr. PUGSON any remarks to make?

**Mr. Pugson.** — No, I agree with the text.

**The President.** — Is everyone agreed about Summary 3? *(Agreed.)*

— *Summary 3 was adopted.*

**Mr. Martinelli.** — *Summary 4 :*

4. The use of bogies without swing bolsters has been very limited to date, and is not likely to be made general.

**The President.** — Does everyone agree to the wording of Summary 4? *(Agreed.)*

— *Summary 4 was adopted.*

**Mr. Martinelli.** — *Summary 5 :*

5. An increase in the flexibility of the springs is likely to improve the comfort. It may also be necessary on account of the lightening of rolling stock, plate springs, coiled springs or a combination of the two types remaining current practice. The use of coiled springs is extending compared with that of plate springs.

**Mr. d'Arbela.** — I think we might substitute the word « même » for « toutefois » (« even » for « also » in the English text) and say : « An increase in the flexibility of the springs is likely to improve the comfort, it may *even* be necessary... ».

**The President.** — Does the Meeting agree to this suggestion?

**Mr. Baeyens,** *Belgian National Railways* (in French). — I am wondering if we could not leave out the second part of the sentence since it is stated « An increase in the flexibility of the springs is likely to improve the comfort ». In view of the fact that with light weight stock it is necessary to increase the flexibility, I suggest the second part might well be suppressed.

**Mr. Martinelli.** — The second part of the sentence merely states that there are also other reasons for increasing the flexibility.

**Mr. Parmantier.** — Mr. President, I think the text might be left as the Reporter drew it up, simply leaving out the word « toutefois » (« also »). There are two different ideas involved, and we would say : « An increase in the flexibility of the springs is likely to improve the comfort; it may be necessary on account of the lightening of rolling stock ».

**Mr. Martinelli.** — « It may *also* be necessary on account... ».

**Mr. Parmantier.** — I would leave out « toutefois » and simply say : « it may be necessary... ».

**Mr. Uytborck.** — If we say « aussi » this will correspond exactly with the English text where the word « also » is used.

**Mr. Parmantier.** — You can say « aussi », it is not very important.

**The President.** — There are two proposals therefore : to replace « toutefois » by « aussi » in the French text or suppress the word « toutefois ». Which do you prefer?

**Mr. Parmantier.** — « Aussi » if you like.

**The President.** — « Aussi »? All right, and the English text will remain unaltered.

— *Summary 5 was adopted, the word « toutefois » being replaced by « aussi » in the French text.*

**Mr. Martinelli.** — *Summary 6 :*

6. The use of torsion bars is not very extensive. Rubber is used more and more for auxiliary springs but not often for the main springs.

**The President.** — No remarks?

**Mr. Uytborck.** — Is the result of using rubber for the main spring not known?

**Mr. Martinelli.** — There are some examples, but it is not the current practice. Trials are being carried out.

**Mr. Uytborck.** — It should be possible to say : « It is rarely used for the main spring because it either does not meet requirements or it costs too much ».

**Mr. Martinelli.** — It is above all a question of the load. There are difficulties in carrying the load per axle with rubber springs.

**Mr. Uytborck.** — It is therefore a question of difficulty of construction.

**Mr. Martinelli.** — To carry the necessary loads, the springs would have to be very large.

**Mr. Uytborck.** — Could we not add : « because they are difficult to design » or something of the sort?

**Mr. Martinelli.** — I could not draw such a conclusion from the replies received. In actual fact the Administrations gave no information about the difficulties experienced nor the reasons against the use of rubber springs for the main springs.

**Mr. Uytborck.** — If that is so, I think we can leave the Summary as it is.

**The President.** — Agreed. *(Agreed.)*

— *Summary 6 was adopted.*

**Mr. Martinelli.** — *Summary 7 :*

7. Some railways check the damping out of the vertical and horizontal oscillations, either by combining different types of springs or by hydraulic shock absorbers.

**The President.** — Are we all agreed about this text?

**Mr. Hoffet,** *Swiss Federal Railways* (in French). — We use ferodo type friction dampers on the locomotives. I should be interested to know if shock absorbers of this type are also used on the coaches. I might say that ferodo dampers have the drawback of working in jerks.

**Mr. Uytborck.** — If I understand you rightly Mr. HOFFET, you want to know if there are the same drawbacks in the case of coaches as you have experienced on the locomotives?

**Mr. Hoffet.** — I should like to know if mechanical dampers, i. e. ferodo friction dampers, are used on coaches, as at the end of Summary 7 only hydraulic shock absorbers are mentioned. If so, I should suggest to alter Summary 7 accordingly.

**Mr. Martinelli.** — No Administration reported using friction dampers on coaches. I think that the friction damper acts too suddenly. The friction of the dampers produces the same effects as the friction of laminated springs, which is unsuitable for coaches. Their use on locomotives gives good results, but in the case of coaches something more gradual is needed. This is my personal opinion; no Administration raised the point.

**The President.** — Are we all agreed about the wording of Summary 7? *(Agreed.)*

— *Summary 7 was adopted.*

**Mr. Martinelli.** — *Summary 8 :*

8. For high speed rolling stock, there is a general tendency to reduce the play in the axle box guides, either by using special materials, or by special designs of guides without play.

**The President.** — No remarks?

— *Summary 8 was adopted.*

**Mr. Martinelli.** — *Summary 9 :*

9. According to certain railways, the reduction of the coning of tyres makes it possible to improve the comfort by reducing hunting. This measure however results in increased wear of the flanges.

**The President.** — No comments?

— *Summary 9 was adopted without remarks.*

**The President.** — This brings us to the end of the Summaries for Question IV, sooner than we expected. I think we should express our sincere thanks to Mr. Martinelli, the Special Reporter, who summed up the different reports so clearly and accurately. Perhaps, some of the members, now, or to-morrow when the meeting begins, would like to make some general observations on the subjects dealt with under Question IV, subjects which are of great importance from the passenger's point of view, and consequently from the point of view of encouraging him to travel. We will introduce the corrections and modifications to the text approved this morning, so that each one of you can read them in your own language before voting on them.

We will begin our meeting to-morrow by examining the modifications suggested to some of the Summaries during this present Meeting, the text of which will be distributed.

**Mr. Uytborck.** — Does anyone wish to say anything about any of the Summaries discussed this morning?

— *As no one wished to say anything, the Meeting came to an end.*

## Meeting of the 27th September 1950.

President : Lord Hurcomb.

— The Meeting began at 9 a.m.

**The President.** — Gentlemen, may I remind you that two Summaries were left open yesterday.

The first is Summary No. 6 of *Chapter D : Fittings.* You will find on page 9 of No. 2 of the *Daily Journal* which was distributed to you this morning, the suggested modification proposed by Mr. Pugson in the name of the British delegation which consists of the following addition : « except on the British Railways, where the practice is to provide corridor and non-corridor stock ».

Summary 6 would therefore be worded as follows :

« 6. The central corridor is almost general practice in the case of stopping train coaches and also for railcars and rail motor coaches, except on British Railways where the practice is to provide central corridor and also non-corridor stock. »

Does Mr. Pugson agree to this text?

**Mr. Pugson.** — Yes.

**The President.** — Does the Meeting agree to this addition? *(Agreed.)*

— *Summary 6, modified in this way, was adopted.*

**The President.** — The second summary held over from yesterday is Summary No. 2 of Chapter E : *Stability of running*. You will find on page 9 of No. 2 of the *Daily Journal* the new text which is now submitted to you which reads as follows :

« 2. Such bogies can be used for very high speeds provided that special conditions of maintenance are observed for the stock and that the track is in a very good state. »

Do you agree to this wording?

**Mr. Parmantier.** — Mr. President I would prefer the word « very » to be left out, saying : « ... and that the track is in a good state ».

**The President.** — Are we all agreed to leave out the word « very »? *(Agreed.)*

Summary 2 will therefore be worded as follows :

« 2. Such bogies can be used for very high speeds provided that special conditions of maintenance are observed for the stock and that the track is in a good state. »

Agreed? *(Agreed.)*

*— Summary 2, modified in this way, was adopted.*

*— The Section then began to discuss Question V.*

# DISCUSSION AT THE PLENARY MEETING.

## Meeting held on September 29th, 1950.

DR. ENG. G. DI RAIMONDO, PRESIDENT, IN THE CHAIR.
GENERAL SECRETARIES : MR. P. GHILAIN AND DR. ENG. M. VALDIVIESO.
ASSISTANT GENERAL SECRETARY : MR. CH. E. WHITWORTH.

**The President** (in French). — Gentlemen, we will now examine the Summaries relating to Question IV.

**Mr. Ghilain**, *General Secretary* (in French). — The text of the Summaries for Question IV appeared in the *Daily Journal of the Congress*, No. 2 of the 27th September 1950 and No. 3 dated 28th September 1950.

*(No objections were raised during the examination of these Summaries.)*

**The President.** — We may therefore consider the Summaries for Question IV as adopted.

### SUMMARIES.

#### A. Sound insulation.

« 1. The experiments carried out by « different railways prove that elastic « wheels do not lead to any appreciable « improvements from the point of view « of the sound insulation of vehicles. « Such types of wheels can even be the « source of parasitic vibrations in themselves.

« 2. It is possible to reduce the formation of noise by :

« — simplifying the brake rigging « and doing away with a central rigging;

« — providing suitable guides for all « the moveable parts of the body;

« — covering the body sheets with « absorbant substances and reducing the « size (area) of sheets used;

« — using helicoidal gears in the « drive of railcars and ground gears for « rail motor coaches.

« 3. The use of anti-vibration packings between body and bogie is very « widespread.

« 4. The suspension of the heat « engines is always completed by very « elastic rubber packings.

« 5. In the construction of up-to-date « rolling stock, extensive use is made of « absorbant substances on the walls, « floors, ceilings and doors.

« Such substances provide satisfactory « heat insulation. The latter is completed, in very cold countries, by the « use of double windows.

« 6. There is a tendency to equip railcars with a platform or luggage compartment between the compartments « and the driving compartment.

« 7. The transmission of noise can be « reduced by carefully packing the trap- « doors in the floors and the holes for « the pipes and conduits.

### B. Lighting.

« 1. Up to the present incandescent « lamps have been widely used. Fluor- « escent lighting is now developing very « rapidly.

« 2. At the present time the filaments « of incandescent lamps are screened by « using either opaque bulbs or opaline « diffusers.

« 3. For some years there has been « an appreciable increase in the amount « of light provided (90 lux in 1st and « 2nd classes; 50 lux in 3rd class at read- « ing level). With equal power install- « ed, the lighting can be tripled approxi- « mately by the use of fluorescent « tubes.

### C. Heating. — Air conditioning. Ventilation. — Heat insulation.

« 1. With steam heating, there is a « general tendency to increase the feed « pressure in the main steam pipe in « order to improve the heating of the « last few vehicles of the train.

« 2. In the corridors of compartment « coaches, the steam or electric radiators « are arranged either against the body « sides or against the compartment par- « titions, or in the compartments them- « selves. Some railways use the actual « steam conduit as a radiator for heating « the corridors.

« 3. Direct electric heating by radia- « tors is the most widely used and most « economical method. It gives satis- « factory results provided the circulation « of air around the heating elements is « adequate.

« 4. Pulsated air electric heating « increases the comfort, and also makes « it possible to ventilate the vehicles « during the summer. However, the « consumption of current in high and « low tension is much higher than with « direct heating.

« 5. There is a general tendency to « adopt heating of compartments indi- « vidually, with thermostatic control.

« 6. In railcars, heating by the engine « cooling water or exhaust gases does « not usually give sufficient comfort. « On both vehicles and trailers the pre- « sent tendency is towards the use of « coal or oil systems of heating. In the « latter case, the working can easily be « made automatic.

« 7. Coaches not equipped with air « conditioning or pulsated air heating « are nearly always equipped with ven- « tilators in the ceilings or walls. A few « applications of forced ventilation have « also been carried out.

« 8. Air conditioning is in general use « in the U. S. A. and in tropical coun- « tries. In Europe, it has only been « tried to a very limited extent.

« 9. In coaches equipped with air « conditioning with cooling equipment, « use is always made of double fixed « windows.

### D. Fittings.

« 1. In coaches of European con- « struction, the seats always face each

« other, whilst in America, Australia « and Africa they often face in the same « direction, and can generally be revers- « ed and have adjustable backs. It « may, however, be noted that trials are « being undertaken in Europe with « adjustable and reversible seats.

« 2. In Europe, springs and hair are « used to upholster the seats. In Ame- « rica, Australia and Africa, sponge rub- « ber is also used.

« 3. The use of leather or similar « synthetic products has been greatly « extended for seat coverings, except in « cold countries and in Europe, where, « particularly in first and second classes, « textile materials are still widely used.

« 4. Head and arm rests are still « used in 1st and 2nd classes and also « in third class in certain countries.

« 5. There is a definite tendency to « provide upholstered seats in 3rd class, « as well as seats that can be turned into « berths on coaches making long runs.

« 6. The central corridor is almost « general practice in the case of stop- « ping train coaches and also for railcars « and rail motor coaches, except on « British Railways where the practice is « to provide central corridor and also « non-corridor stock.

« 7. In Europe the main line stock « often has a side corridor, whilst in « America, the centre corridor is the « most common.

« 8. In Europe, there are 3 seats a « side in 1st class, 4 and sometimes 5 « in 3rd class. There are 3 or 4 seats « a side in 2nd class.

« 9. In all American coaches and, in « general, in railcars and in rail motor « coaches, there are 4 seats a side.

« 10. Plywood or composition mater- « ial (Masonite) is widely used to cover « the walls. Special coverings of plastic « materials are also being used.

« 11. The floors are generally cover- « ed with linoleum, and more rarely « rubber. These materials are some- « times covered by a carpet in 1st class.

« 12. The walls of W. C.s are cover- « ed with painted, enamelled or vitrified « sheets. There are also some examples « of rustless steel being used, or ply- « wood covered with plastic materials.

« 13. The floors of W. C.s are in « mosaic or earthenware tiles, in rubber « with coverings, special asphalt or « cement, or metal grills.

« 14. Hot water for washbasins in the « W. C.s is beginning to be provided « more generally, especially during the « winter.

### E. Stability of running.

« 1. Most Administrations continue « to use the classic types of bogies on « their up-to-date stock as previously « standardised.

« 2. Such bogies can be used for very « high speeds provided that special con- « ditions of maintenance are observed « for the stock and that the track is in « a good state.

« 3. Bogies of special types for ordin- « ary and high speeds have recently been « tried and seem likely to be generally

« used on the future rolling stock of « some railways. However, in the « design of bogies other factors than the « comfort must also be taken into « account (cost, weight, ease of main- « tenance).

« 4. The use of bogies without swing « bolsters has been very limited to date, « and is not likely to be made general.

« 5. An increase in the flexibility of « the springs is likely to improve the « comfort: It may also be necessary on « account of the lightening of rolling « stock, plate springs, coiled springs or « a combination of the two types « remaining current practice. The use « of coiled springs is extending com- « pared with that of plate springs.

« 6. The use of torsion bars is not « very extensive. Rubber is used more « and more for auxiliary springs but not « often for the main springs.

« 7. Some railways check the damp- « ing out of the vertical and horizontal « oscillations, either by combining dif- « ferent types of springs or by hydraulic « shock absorbers.

« 8. For high speed rolling stock, « there is a general tendency to reduce « the play in the axle box guides, either « by using special materials, or by spe- « cial designs of guides without play.

« 9. According to certain railways, « the reduction of the coning of tyres « makes it possible to improve the com- « fort by reducing hunting. This mea- « sure however results in increased wear « of the flanges. »

[ 621 .135 & 625 .21 ]

## QUESTION V.

**Improvements in the construction of rolling stock (motor and trailer) in view of increasing the mileage between repairs :**

**Solid wheels or with tyres (metal used for the tyres and solid wheels, behaviour in service);**

**Axle boxes;**

**Wearing and friction metals;**

**Springs (qualities, shape, manufacture).**

### Preliminary documents.

Report (America (North and South), Burma, China, Egypt, Great Britain and North Ireland, Dominions, Protectorates and Colonies, India, Iran, Iraq, Malay States and Pakistan), by E. PUGSON and L. LYNES. (See *Bulletin* for April 1950, p. 683, or separate issue No. 14.)

Report (Austria, Bulgaria, Czechoslovakia, Finland, Greece, Hungary, Italy, Portugal and Colonies, Rumania, Spain, Sweden, Turkey and Yugoslavia), by A. D'ARBELA and M. FASOLI. (See *Bulletin* for July 1950, p. 1449, or separate issue No. 30.)

Report (Belgium and Colony, Denmark, France and French Union, Luxemburg, Norway, Netherlands and Colonies, Poland, Switzerland and Syria), by M. G. CHAN. (See *Bulletin* for August 1950, p. 1755, or separate issue No. 36.)

*Special Reporter :* G. CHAN. (See *Bulletin*, October 1950, p. 2057.)

## DISCUSSION BY THE SECTION.

### Meeting of the 27th September 1950.

PRESIDENT : LORD HURCOMB.

— The Meeting opened at 9.15 a.m.

**The President.** — Gentlemen, as we have finished examining Question IV, we now come to Question V : *Improvements in the construction of rolling stock (both motor and hauled or trailer), in order to increase the mileage between repairs.*

Will the Special Reporter please read us the Summaries from his report.

**Mr. Chan**, *Special Reporter* (in French). — Gentlemen, *Summary 1* is worded as follows :

1. *Tyre wear* determines generally the mileage between repairs to the running gear and frame.

*Modern equipment* has made it possible to extend the mileage between repairs with a more intensive utilisation and in certain cases an increase in load and speed.

*New rolling stock* is ordered for various reasons: saving in working costs, higher speed, greater safety, more comfort. The saving in maintenance costs, whilst not the overriding factor, enters into these reasons.

**The President.** — You can now discuss this Summary.

**Mr. Bond,** *British Railways.* — I should like to propose that the conclusion that tyre wear determines generally the mileage between repairs to the running gear and frame does not give the right impression. Although it may be so in the case of coaching stock, in the case of steam locomotives, and also electric locomotives, the conclusion should be worded to indicate that when the improvements that are referred to are incorporated in the design of coaching stock or locomotives then, and only then, does tyre wear determine the mileage between repairs. If the delegates referred to Mr. CHAN's report, on page 756 he points out in detail that the running gear, wheels, axleboxes and metal parts, subject to wear, are those which condition the mileage between repairs, but when there are the improvements with the latest type we know of, it is then, and only then, I think, that tyre wear really does determine the mileage. I think a permanent note should be made that this was mentioned by the Netherlands and Norwegian Railways, and it certainly would be the case so far as British Railways are concerned at the moment.

**Mr. Chan.** — It is true that the Netherlands Railways and Norwegian Railways mentioned not only tyre wear but also wear of the boxes and mechanism as reasons for stock undergoing repairs. But the Summary states : determines « generally » because according to the majority of the replies, it is tyre wear which determines the need for repairs.

Is it necessary to mention in the Summary that part of the report stating that certain Administrations found the period between repairs limited by the wear of the boxes and mechanism? It did not seem necessary to us, but if you wish to include it, I see no drawback.

**Mr. Bond.** — It is proposed that the word « generally », which, I think, gives the wrong impression, is deleted, and I feel that the conclusion, at any rate so far as Great Britain is concerned, would be more accurate if we add the other factors; these are also very much in the forefront in determining the mileage.

**The President.** — Are you of the opinion that the word « generally » is sufficiently restrictive, or do you think it advisable to give additional details?

Could any delegate from Norway or Holland give us such details or make any suggestions?

**Mr. de Haas,** *Netherlands Railways* (in English). — It is true that in the case of certain locomotives, repairs are determined by the general condition of other components than the wheels, but I think that the expression « generally » gives sufficient indication that other considerations may be taken into account.

**Mr. Pugson,** *Reporter.* — I think that it could be better expressed and made clear in paragraph 2. I would suggest that

this should read « modern equipment including better tyre steel has made it possible to extend the mileage ».

**Mr. Cuttica,** *Italian State Railways* (in French). — The mileage between two consecutive repairs is sometimes determined by the actual nature of the service itself. For example coaches intended for particularly fast services on the international lines have to be overhauled at shorter intervals than those used for other services.

The information given by Mr. CHAN obviously refers to the wear of the mechanism and the body. There is also the safety of the passenger to be considered. When we simply say « generally » we are thinking in terms of the wear. If other considerations are added, for example the more stringent service required of a wagon or coach, it is obviously another matter.

It might perhaps be advisable to say : « Other considerations may also lead to a shorter interval between two repairs .»

**The President.** — I should be glad if Mr. PUGSON would tell us exactly what modification to the wording he has in mind.

**Mr. Pugson.** — I suggest « modern equipment including better tyre steel has made it possible to extend the mileage ».

**Mr. Chan.** — The effects of the quality of the tyres is dealt with in a special summary.

By « modern equipment » we mean engines equipped with all the improvements mentioned in the report. If we said « specially modern engines and in particular those with harder tyres », we would have to list all the improvements.

To satisfy Mr. PUGSON we might perhaps say : « Modern engines, i. e. those fitted with the improvements mentioned in the report... » in order to make it quite clear what is meant by modern equipment. This includes in particular the quality of the tyres.

I suggest that we must not speak now particularly about one of the conditions but eventually to insist upon same later on, when we will deal with the quality of the tyres.

**The President.** — Does the British delegation accept this proposition?

**Mr. Pugson.** — Agreed.

**Mr. Chan.** — The second paragraph will be worded as follows : « *Modern equipment*, that is the stock provided with the improvements mentioned in the report... », etc.

To meet Mr. CUTTICA's request, we might add in the first paragraph : « other considerations may however, in the case of passenger stock... »

**Mr. Cuttica.** — « ... and goods » also.

**Mr. Chan.** — « ... in the case of passenger and goods stock reduce the periods between repairs ».

**Mr. Parmantier,** *French National Railways* (in French). — Mr. President, would it not be better to say : « Other considerations may, for certain categories of stock... »?

**Mr. Chan.** — Instead of saying « passenger stock »?

**Mr. Parmantier.** — We might say : « Other considerations may however... »

**Mr. Chan.** — « ... in the case of certain stock, reduce the period between repairs ».

**The President.** — The expression « generally » in this text already covers Mr. CUTTICA's remark.

**Mr. Cuttica.** — As I have just said, the Summary refers solely to considerations concerning the stock in use, whereas my suggestion deals with safety, with the measure of prudence, which quite apart from wear of the tyres or other components requires shorter intervals between two repairs in the case of stock in heavy service, in important services, for example the international services.

I think that in such a case it is necessary to carry out overhauls at shorter intervals, and that this is the general practice moreover.

**Mr. Chan.** — I agree with the PRESIDENT.

**The President.** — I am of the opinion that if we are going to insert all these considerations in the summaries, they will not longer be summaries but merely a reproduction of the report.

Does the Meeting agree to the following text :

« 1. *Tyre wear* determines generally the mileage between repairs to the running gear and frame.

» *Modern equipment, that is the stock provided with the improvements mentioned in the report*, has made it possible to extend the mileage between repairs with a more intensive utilisation and in certain cases an increase in load and speed.

« *New rolling stock* is ordered for various reasons : saving in working costs, higher speed, greater safety, more comfort. The saving in maintenance costs, whilst not the overriding factor, enters into these reasons. »

*(Agreed.)*

*— Summary 1, modified in this way, was adopted.*

**Mr. Chan.** — *Summary 2 :*

2. *One piece wheels* have been tested by many Administrations. They avoid tyre movement and in the case of carriages, railcars and motor coaches, the wheels can be lightened.

The information on cost price of these and tyred wheels does not agree. It has to be remembered that the service conditions are different, and that the one piece wheel is not manufactured at present in Europe in large quantities. Heat treating of the tread is advised to get at least the mileage of tyred wheels or better, to exceed it. Increasing the resistance to wear and ultimately the possibility of repairing by welding are two benefits more readily obtained with one piece wheels than with tyred wheels, wherein the shrinkage stress alters the allowable working stress in the tyre. It appears desirable that the experience with one piece wheels be followed up.

**Mr. Pugson.** — After the word « quantities » in the second paragraph, I would like it to read « except in Great Britain where wheels of this type are almost exclusively used for wagon stock ».

**The President.** — Has anyone any remarks to make about this suggested addition ?

**Mr. Chan.** — I would like to ask Mr. PUGSON if it is a question of the steel.

**Mr. Pugson.** — Yes, steel rolled disc wheels.

**Mr. Chan.** — In this case, the Summary stating that they are not manufactured in large quantities is contradicted by the facts in England, and it would be better to leave out this allusion to manufacturing conditions.

I consequently suggest omitting the following sentence : « ... and that the one piece wheel is not manufactured in Europe at present in large quantities ».

**The President.** — Does Mr. Pugson agree?

**Mr. Pugson.** — Regarding the question of welding benefits; British Railways have been welding tyred wheels for many years and have welded to date many thousands of tyres without difficulty. We have not, to date, welded solid tyres because they have not been running long enough.

**Mr. Uytborck,** *Principal Secretary* (in French). — Could we not simply leave out the words « more readily obtainable» ? This phrase sounds rather doubtful to me. Would it not be preferable to say : « are two benefits which are — or which can be — obtained » ?

**Mr. Chan.** — I agree.

**Mr. Uytborck.** — It is rather more affirmative.

**The President.** — Take out « ultimately ».

**Mr. Chan.** — Yes, the word « ultimately » must be left out.

**Mr. Uytborck.** — The English text does not correspond exactly with the French text.

**Mr. Pugson.** — I do not agree with the word « seem ».

**The President.** — Mr. Pugson, if we take out the word « ultimately », will that meet you?

**Mr. Pugson.** — I do not agree that they are more readily obtained with one-piece wheels; they are not more readily obtained. We have been welding for years.

**The President.** — Do you wish to take out the words « more readily ».

**Mr. Pugson.** — That would probably meet my case.

**Mr. Chan.** — I only suggested leaving out the word « ultimately ».

**Mr. Uytborck.** — Retaining « which seem to be ». I am not quite clear what Mr. Pugson means.

**Mr. Pugson.** — « More easily » seems to me too vague.

**Mr. Uytborck.** — The French text would therefore read :

« L'augmentation de résistance à l'usure et la possibilité de réparation par soudure sont deux avantages qui peuvent être obtenus plus aisément sur

une roue monobloc que sur un bandage où l'existence... », etc.

The words « plus aisément » must be retained.

**Mr. Pugson.** — I cannot agree with that Mr. Chairman.

**The President.** — This is not satisfactory. Mr. PUGSON will you please explain your point of view again.

**Mr. Pugson.** — We on British Railways have for many years repaired the bottom of the flange by depositing weld material. Such an operation saves about half the amount of tyre that it is necessary to turn off to get a full profile of the flange. We have been doing that since 1930 on one of the Regions of British Railways without difficulty and, therefore, I cannot agree that one of the benefits which is going to be obtained by using one-piece, that is solid wheels, is that they are more readily welded than tyred wheels. We have done it on tyred wheels since 1930; we have never done any on solid wheels.

**Mr. Uytborck.** — Mr. PUGSON has just stated that the British Railways do it in the case of tyred wheels, but not yet in the case of one piece wheels. Their point of view is the opposite to that of Mr. CHAN.

**Mr. Chan.** — Yes, this point of view is the opposite.

**The President.** — I should like Mr. PUGSON to let us have a text which expresses his exact view. I think you must suggest how this Summary should be amended.

**Mr. Bulleid,** *Coras Iompair Eireann, Ireland.* — May I say something on this subject. A tyred wheel has a limit of wear down to the minimum thickness which is determined by the shrinkage of the tyre. If a solid wheel has the tread built up by welding as there is no tyre shrinkage to consider the wheel can be worn further, that is, to a thinner rim thickness. I consider the correct interpretation should be « there is less risk in welding a one piece wheel than a tyred wheel ».

**Mr. Chan.** — In this case, if I understand rightly, Mr. BULLEID agrees with the wording?

**Mr. Bulleid.** — Yes.

**Mr. Chan.** — Mr. BULLEID says that there are however less risks in welding a one piece wheel than a tyred wheel. A priori?

**Mr. Bulleid.** — A priori.

**Mr. Chan.** — Since the British Railways have no experience of the matter, I wonder if we are not expressing an opinion somewhat *a priori*. To settle the question, the British Railways should have built up some single piece wheels, but according to Mr. PUGSON this has never been done.

**Mr. Pugson.** — Not yet.

**Mr. Chan.** — So perhaps the character of the hypothesis should be accentuated. That is why we said : « which seems ».

Have the Swiss Federal Railways who have a great many one piece wheels on their coaches no experience in this field?

**Mr. Hoffet,** *Swiss Federal Railways* (in French). — They are built up by welding.

**Mr. Chan.** — Mr. HOFFET, have you had any accidents with tyred wheels built up by welding?

**Mr. Hoffet.** — At first, some tyres burst when built up by welding, but now we have been able to get rid of the cracks and any risk of the tyre bursting.

**The President.** — Would it not be best if Mr. CHAN and Mr. PUGSON discussed the matter together, and see if they could put before to-morrow's meeting a wording which is accurate and representative of the different opinions which must be mentioned in this Summary?

Do you agree to this suggestion? *(Agreed.)*

*— The text of Summary 2 will therefore be held over, and we will go on to Summary 3.*

**Mr. Chan.** — *Summary 3 :*

3. To increase the mileage between repairs and reduce wear with harder rails some railways use *tyres* of 90 kg/mm² (57.14 t. per sq. in.) quality.

*Lubrication of the flanges or the rails* is desirable to reduce the reciprocal wear of these two parts. Most Administrations carry the lubricator on the engine. Many and various arrangements are used.

**The President.** — Any observations on this Summary?

*— Summary 3 was adopted.*

**Mr. Chan.** — *Summary 4 :*

4. *Independent wheels* have been tested by some Administrations (British Railways (L. M. R.), Italian State Railways and Swiss Federal Railways) but the wear was rapid and irregular. The use of such wheels at least under the conditions used in the trials is not to be recommended.

**The President.** — Is that agreed by everyone?

**Mr. Cuttica.** — I suggest that after the words « ont donné lieu » (but resulted) we put the word « frequently » because the use of tyred wheels has not always resulted in drawbacks. If we say « frequently » this will explain that wear occurred in certain cases, but not in every case.

**Mr. Chan.** — We do not say that it always gives rise to rapid and irregular wear.

**Mr. Cuttica.** — By stating that the trials carried out by the Italian Railways gave rise to rapid wear, you are making an inaccurate statement. By adding the word « frequently » the sentence can however be retained without any other modification.

**Mr. Chan.** — The word « souvent » (often) might be inserted.

**The President.** — Insert « souvent » in the French text and « often » in the English text. Is that agreed?

**Mr. Bulleid.** — Might I make an observation? It seems to me that Summary 4 should be suppressed. As the tests that were being carried out were on too small a scale to decide such a question, it may well be that independent wheels will come

in due course, as they have on road vehicles, where the same difficulties were experienced in the beginning and the wheels were in many quarters condemned. Yet, at the present time, the individual wheel is in universal use. I think this conclusion is based on insufficient evidence and should be suppressed.

**Mr. Chan.** — We also share this hope. We considered making some trials with independent wheels, but it must be recognised that the results proved that they could not be adopted. For this reason, we made a reservation by saying « at least under the conditions used in these trials », without completely condemning them.

Do you not consider this reservation sufficient, Mr. BULLEID?

**Mr. Bulleid.** — No, I do not think it is sufficient.

**Mr. Chan.** — We do not state that we will never consider using independent wheels, but we state that they are not recommended under the conditions used during these trials. This is simply a statement of fact.

**Mr. Bulleid.** — It makes the conclusion quite useless.

**Mr. Chan.** — I see no objection to leaving out the last three lines. Since it is reported that the trials resulted in wear, it is without prejudice for the future.

**Mr. Parmantier.** — Mr. President, all the same I think we should report the conclusion the trials actually led to. The wording of the text before us might however be modified. Trials have been made of independent wheels; I think, as Mr. BULLEID says, that these trials may turn out successful, but up to the present they have not been so, and the Summary merely states this fact.

**Mr. Read,** *New Zealand Government Railways.* — I should like to say that this statement does not give us a complete view of the present state of affairs, because independent wheels are being used successfully by one or two undertakings in special cases. I think we should at least say that they are satisfactory in special cases; that would be a statement of observed fact, and thus give a true picture of the present position regarding the use of independent wheels.

**Mr. Chan.** — In the replies we received, we did not find anything about any successful trials. That was why the report merely mentioned trials which had not given good results.

**Mr. Read.** — On page 2062 of the English edition of the October 1950 Bulletin under the title « Independent wheels » it says :

« The only satisfactory results, i.e. without abnormal wear, are in the case of wheels in the middle of 6 or 8 wheeled bogies with the outer wheels of the usual type (S. N. C. F. Bugatti railcars, and New Zealand Vulcan railcars). »

If no replies mentioned any satisfactory results, where did the Reporter obtain the information given in his special report?

**Mr. Lynes,** *Reporter.* — In regard to this matter of independent wheels, I wish to draw attention to the fact that in the English Report, page 721 of the April Bulletin, there is a statement from the New Zealand Government Railways that « The middle axle of the 6 wheeled Vulcan rail cars has independent wheels because the axle has a set in it to clear the engine. The tyre wear is normal . »

**Mr. Chan.** — The case mentioned by Mr. LYNES is given in the report under the heading « Independent wheels ». It states that some such wheels have been satisfactory when they are in the middle of a bogie. This is stated in the report; it is not mentioned in the summaries because it is question of rather special wheels, and not of guiding wheels.

**The President.** — I think the Section should now decide whether to suppress this paragraph, as Mr. BULLEID has proposed, or whether they would prefer it to stand with some modification. If it is to be retained, perhaps, instead of the last sentence, which I think would be taken generally, especially by non-technical people, as the rejection of independent wheels, we might say something to the effect that before any clear conclusion can be formed as to their eventual success, further trials, or much further trials, are required. Those seem to me to be the alternatives.

**Mr. Chan.** — First of all, to answer MM. READ and LYNES, I would like to say that the Summary refers to independent guiding wheels, and not to wheels which are not guiding wheels, where the question of wear is of no importance.

I think we might meet your objections by being more explicit and saying : « *Trials of independent wheels* used as guiding wheels » to be more explicite « have been tested by some Administrations... », etc. We would therefore be adding « used as guiding wheels », which would mean that when they are not used as guiding wheels — as is the case in New Zealand — there is no wear.

**Mr. Bulleid.** — Mr. President, may I withdraw my recommendation in favour of your suggestion; that is the modification you propose that tests should be made on a much larger scale before any conclusion can be come to.

**Mr. Chan.** — I think we should be agreed if we stated : « Trials should be carried out under other conditions » or « on a wider scale and under other conditions ».

**Mr. Bulleid.** — « ... should be continued on a greater scale and *under all possible conditions* ».

**Mr. Chan.** — I would say in particular « under other conditions than those already used ».

**Mr. Parmantier.** — Trials of such wheels can certainly be continued, but this is not an obligation. Therefore, the Summary should not state that there is interest in continuing these trials.

**The President.** — That is how it should be. This does not tie any Administration and does not prevent it being done if so desired. Each one can just look upon the

opinion of the Congress as a matter of information.

**Mr. Parmantier.** — It is a question of the wording.

**Mr. Uytborck.** — Mr. CHAN, can you suggest a text which takes into account the remarks just made?

Are we to retain your remark about guiding wheels?

**Mr. Chan.** — I suggest that this detail should be retained.

**Mr. Bulleid.** — Might I propose the following wording « Before any definite conclusion can be formed, it is desirable that much more experience be gained and much more extensive trials undertaken ». The matter would then be completely open.

**Mr. Chan.** — We might say : « Before coming to any definite conclusions, it is necessary to await the results of trials carried out under different conditions ».

**The President.** — I think this meets the situation very well, Mr. BULLEID. We can consider the final wording to-morrow. This one can be kept provisionally and submitted to approval. Except for a few verbal alterations, this is agreed by the Meeting.

*— The text of Summary 4, modified in order to take into account the different suggestions made, will be submitted to the Section for approval at to-morrow's Meeting.*

**Mr. Chan.** — *Summary 5 :*

5. *Roller bearing boxes* tend to be increasingly used in view of the reduction in hot boxes and the saving in maintenance. In the case of steam locomotives, the use of these boxes on the driving or coupled axles reduces wear, which results in an important increase in mileage between repairs.

The few incidents reported in connection with the journals can be ascribed to these journals being too small.

In view of the high price of roller bearing boxes, there are cases wherein other types of box can be preferred.

When *roller bearings are fitted to electric locomotives and motor coaches,* devices to prevent the electric current from passing through the roller bearings are fitted.

**Mr. Baeyens,** *Belgian National Railways* (in French). — I do not agree with the last paragraph of this Summary. In Belgium, where we make use of roller bearing boxes grease lubricated, we have not fitted any device to prevent the electric current passing through the boxes.

**The President.** — No other comment?

**Mr. Chan.** — The wording does not imply that it is obligatory to use such devices. The Italian Railways in certain cases also have given up using any device to return the current provided there is a connection between the boxes and the frame. We simply pointed out that such devices are used, but they are not in general use.

**Mr. Baeyens.** — We might add the word « generally ».

**Mr. Chan.** — I agree.

**The President.** — Are there any other remarks?

**Mr. Bond.** — In the first paragraph of Summary No. 5 it is said in the second phrase that : « In the particular case of steam locomotives, the use of these boxes on the driving *or* coupled axles gives a reduction in wear, resulting in a substantial increase in mileage between repairs ».

I propose that the above be altered to read :

« In the particular case of steam locomotives, the use of these boxes on the driving *and* coupled axles... » (Replacing the word « or » by « and »), and that a second sentence be added stating that « The use of roller bearing axleboxes on driving axles *only* has also been found by some Administrations to be a means of increasing the mileage between repairs ».

**Mr. Chan.** — As regards Mr. Bond's first request to replace « driving *or* coupled axles » by « driving *and* coupled axles », there is a distinction to be made. If we put « *and* » this would imply that both driving and coupled axles are required. But mention was made in the report of very good results even with driving axles only. These results are better still with the driving axle and all the coupled axles, but very good results are obtained even with driving axle alone. This is why the word « *or* » was used to leave us free to apply it only to the driving axle, which is more economical, rather than to the driving and coupled axles. This is the way in which the wording must be taken.

To be more precise, we might say : the use of these boxes on driving and coupled axles or on driving axles only ». This I think would satisfy the British delegates.

Mr. Bond's second remark deals with the effects obtained by using boxes on the bogies, on the guiding axles.

The result mentioned by Mr. Bond was not brought out in the report. It is possible that bogies fitted with roller bearing boxes decrease the wear of the sets of coupled axles, but I did not find such a result reported in the replies I received, and, in France at any rate, no particular details were given in this field. It is no doubt true, but no definite trials have been carried out on these lines. I think that the results obtained by the use of roller bearing boxes on the bogies are less definite than those obtained by using them on the driving or coupled axles.

**The President.** — Does this satisfy the British delegates? *(Agreed.)*

**Mr. Uytborck.** — Summary 5 will therefore read :

« 5. *Roller bearing boxes* tend to be increasingly used in view of the reduction in hot boxes and the saving in maintenance. In the case of steam locomotives, the use of these boxes on the driving and coupled axles or on the driving axles only provides a reduction in wear, resulting in an important increase in mileage between repairs.

« The few incidents reported in connection with the journals can be ascribed to these journals being too small.

« In view of the high price of roller bearing boxes, there are cases wherein other types of box can be preferred.

« *When roller bearings are fitted to electric locomotives and motor coaches,* devices to prevent the electric current from passing through the roller bearings are generally fitted. »

**Mr. Bond.** — Agreed.

**The President.** — Do you all agree on this text? *(Agreed.)*

*— Summary 5, modified in this way, was adopted.*

**Mr. Chan.** — *Summary 6 :*

6. Amongst oil axle boxes other than of the classic type, should be noted the boxes with mechanical oil circulation, and on steam locomotives, boxes with two brasses completely surrounding the journal (British Rlys. (S. R.) and S. N. C. F.).

Lubricator pads of oil axle boxes are improved by increasing the number of wool wicks and the use of wool of special qualities.

The tendency in Europe is to use high tin *antifriction* metal for high speed locomotives and rolling stock. Rose metal or lead copper (Cu = 69, Pb = 30, Zn = 1) is widely used on the Italian State Railways on goods wagons.

These latter years, the tendency has been to use thin coatings of white metal not exceeding 3 mm (1/8″) thick, but it is noted some Administrations are going back to a rather greater minimum of 5 to 7 mm (13/64″ to 9/32″).

**The President.** — Any observations? Everyone agreed on conclusion 6?

*— Summary 6 was adopted.*

**Mr. Chan.** — *Summary 7 :*

7. The upkeep of parts *subject to wear* is generally done by using detachable wearing plates. Valuable results have been reported in the case of oil axle box guide by using manganese steel (British Rlys) and by using plastic materials (Italian State Rlys. and Paris Metropolitan) or asbestos base material (Norwegian Rlys.).

To improve stability and comfort, and reduce tyre wear, it is desirable to *prevent hunting as far as possible.* One way to achieve this is to avoid longitudinal play in the direction of the track between boxes and frame. Very varied methods of doing this have been used, which either reduce the effects of rubbing or suppress it :

— adjustable or self-adjusting axle box wedges used especially on steam locomotives;

— guides incorporating india rubber fastened to the frame;

— axle box guides in the form of vertical cylindrical pedestals sliding in fitted cylinders (fig. 28, p. 1817/177, August, 1950, *Bulletin*);

— axle boxes connected to frame by rods and silent block bushes (fig. 25, p. 1814/174, August, 1950, *Bulletin*) a solution used on several railways;

— boxes and frame connected by laminated springs placed longitudinally (fig. 30, p. 1826/186 of the August, 1950, *Bulletin*) a variant of the preceding arrangement.

**Mr. Lynes.** — I notice there is no reference to the use of hardened steel bushes for brakework. The advantage is that it saves wear on the part and reduces noise, and I suggest that it is included as one of the features which can be adopted with advantage with a view to reducing wear.

**Mr. Chan.** — We did not mention the bushes used for the brake rigging because this was not so new, and not so interesting to report as the axle box guides. But it is obviously a point to note.

We mentioned the axle box guides because manganese steel was used in this case — which is an interesting new departure to be noted, and plastic mate-

rials as well as asbestos. Hard steel bushes are already in general use.

To meet Mr. Lynes, we might perhaps complete the Summary by mentioning the use of bushes for the brake joints and axle box guides. The two general cases will therefore be mentioned : the rigging and the guides, and we will continue by saying : « Interesting results are reported, especially in the case of axle box guides » and give the three examples.

**The President.** — What is the principle of the alteration? Do you mean that we should add the mention of hard steel bushes reported by Mr. Lynes? The exact wording for this technical matter should be drawn up in agreement between the technical experts whom we shall entrust with this duty. There is time enough before to-morrow for Mr. Lynes, the Special Reporter and other Delegates interested in the matter to get the French text to their liking and for the British Delegates to make sure that it is correctly translated into English.

**Mr. Lynes.** — Agreed.

**Mr. Bond.** — I consider the word « oil » should be deleted in the fourth line of Conclusion 7, and the axlebox guide should be in the plural. The point is that the manganese steel liners are effective and useful whether the axlebox is lubricated by oil or grease, or whether it is an ordinary axlebox or a roller bearing box.

**Mr. Chan.** — It would be better as Mr. Bond says to put « axle box » and leave out « oil box ».

**The President.** — Are we all agreed about this modification. *(Agreed.)*

Are there any other comments upon Summary 7?

*The final text of Summary 7 is left over,* and we will go on to examine Summary 8.

**Mr. Chan.** — *Summary 8 :*

8. *Buckling springs* is generally done hot. There is some extension in Great Britain, and Switzerland, and tests in France of the practice of fitting the buckles on cold.

*Spring steel* should be obtained under such conditions that the same heat treatment in the shops will produce constant results. This can be got either by specifying the chemical composition or by specifying given characteristics to be obtained by a predetermined heat treatment.

*Coiled springs* should have their surface free from defects. Some Administrations (C. F. F., Norwegian Rlys.) report fewer breakages with springs of square and rectangular section, than with round section bars.

**The President.** — No comments?

— *Summary 8 was adopted.*

**Mr. Chan.** — *Summary 9 :*

9. *Rubber,* widely used on buffing and drawgear is now being applied to the spring gear and connecting members between the body and frame of tenders, electric locomotives, motor coaches, railcars, and carriages.

**Mr. Loquet,** *Belgian National Railways* (in French). — The Belgian Railways have had a very unfortunate experience of rubber in the buffing and drawgear, and its use is not going to be extended. The Summary states that it is widely used. It has been used on a certain scale, but its use is now limited, and rubber will no longer be used for the buffing and drawgear.

**Mr. Chan.** — The replies we received stated that in general rubber will continue to be used for the couplings and buffing and drawgear. We did not get any unfavourable replies apart from that reported by Mr. LOQUET. For this reason, we did not think it can be concluded that rubber is no longer being used either for the drawgear or buffing.

Without altering the Summary, we might simply leave out the word « very » which I think will satisfy Mr. LOQUET

**Mr. Loquet.** — I suggest using the word « sometimes » instead of « widely used on... ».

**The President.** — What is the experience of other countries regarding the use of rubber? Have all their replies been favourable?

**Mr. Chan.** — In France especially, a large proportion of the stock is fitted with Spencer-Moulton springs. All our recent tenders — which run to hundreds — and even the motor stock are fitted with rubber buffers of the Spencer-Moulton type.

**Mr. Loquet.** — Possibly, but in any case the front cross members of coaches equipped with Spencer-Moulton buffers in Belgium were damaged.

**Mr. Chan.** — Perhaps the conditions under which they are used should be taken into account.

**Mr. Loquet.** — The methods using ring springs were completely satisfactory from this point of view. We are no longer going to use rubber in the buffing gear.

**The President.** — Does Mr. LOQUET want to alter the Summary?

**Mr. Loquet.** — I would agree to the wording if the words « which is already very widely used » were replaced by « which is often used »; in this way the word « very » would be omitted.

**Mr. Chan.** — Let us say, if you like « which is already used » so as not to give the idea of any widespread use.

**The President.** — Let us leave out the word « très » in the French text and « widely » in the English text, which will not make much difference to the English wording.

**Mr. Pugson.** — The rendering in the English text correctly states that rubber is widely used on the British Railways and all over the world.

**Mr. Chan.** — I think that the word « widely » does not mean anything more that a statement of fact. The use of rubber is widespread, perhaps not universal, but certainly in a great many countries.

**Mr. de Sousa,** *Railway Board, India.* — I can confirm that in India rubber has been used to a very large extent for the buffing gear for a great many years, with entire satisfaction.

**Mr. Binnie,** *Nigerian Railways.* — And so it is on the Colonial Railways.

**The President.** — The Belgian reply did not mention the objection just made

by their delegate. We should like to take this comment into account.

**Mr. Loquet.** — I think it amounts to this, Mr. PRESIDENT, the use of rubber, when it is a question of absorbing large amounts of energy through the buffers, depends sometimes on the rolling stock and operating conditions, and in Belgium, the operating conditions are often rather difficult.

We found that rubber could not absorb the amount of shocks occurring, whereas there was sufficient absorption of energy with ring springs.

I think there is no drawback in retaining this wording since certain Administrations — in fact most of the English Administrations — find it satisfactory.

**Mr. Hug,** *Bernese Alps Railway.* — I have noticed that during the last few years in many countries rubber has been used in the suspension of all kinds of stock and I would suggest that mention be made of the extension of this use for the suspension.

**Mr. Chan.** — I think that the wording of the Summary should satisfy Mr. HUG, since we state that the use of rubber has been extended to the suspension gear. This means that it has proved satisfactory and its use is increasing.

**Mr. Hug.** — I would like to suggest adding the words « ever more » to the Summary, because it seems to me that it is a very rapid extension.

**Mr. Chan.** — I think that the Summary is correct in stating that its use is favourable since it is question of all the stock.

**Mr. Bulleid.** — I suggest the text be maintained. If the Belgians have encountered such great trouble, it may be that their springs are badly designed and we should not alter or suppress the Summary for an incorrect procedure.

**The President.** — We have already said that it is always better to suppress superlatives; we have therefore deleted the word « très » (very) in the French text.

Summary 9 will therefore read as follows :

« 9. *Rubber*, widely used on buffing and drawgear is now being applied to the spring gear and connecting members between the body and frame of tenders, electric locomotives, motor coaches, railcars, and carriages.

Does this wording please you?

*(Agreed.)*

— *Summary 9 was adopted.*

**Mr. De Haas.** — We have experienced some difficulties due to shelling and flaking of tyres of wheels, in particular with the tyres of our electric stock — both motor and trailer vehicles — and we have been recently seeking a solution in other materials. If there are any Administrations represented here who know of a solution, it would perhaps be pertinent to introduce some allusion to this fact.

**The President.** — Do you want another summary to be added Mr. DE HAAS.

**Mr. Binnie.** — Insert whether there are any Administrations experiencing the same difficulties; if so, there is some

reason to include this fact in the Summary.

**Mr. Chan.** — Mr. DE HAAS has gone back to Summary 3, where his statement might be mentioned. His remark refers to single piece wheels just as much as to tyres; it covers all kinds of wheels.

I agree that this is a problem and we should try and find a solution. If the President is agreeable, in Summary 3 : « To increase the mileage and reduce wear in the case of harder rails, certain Administrations use tyres of 90 kg/mm² (57.14 t per sq. in.) quality » we might add the following sentence : « The problem of shelling and scalling is still unsolved, and its solution is of the greatest interest ».

**The President.** — It is rather difficult to go back on what we have already decided. I think if anything is to be added, it ought to be a new summary and that can only be done if the matter was dealt with in the reports. If it is a new point, I think it should be noted in the report of the Meeting but not in the summaries. *(Agreed to by Mr.* DE HAAS.)

Gentlemen, I do not think we can begin discussing Question VI to-morrow as it has already been announced that it has been postponed until Monday next.

We will however meet to-morrow morning at 9 a.m. to finish examining the questions left open today.

— The Meeting adjourned at 11.30 a.m.

## Meeting of the 28th September 1950.

PRESIDENT : LORD HURCOMB.

— The Meeting began at 9.15 a.m.

**The President.** — Gentlemen, our task today is to consider once again the three Summaries left open yesterday, i.e. Summaries 2, 4 and 7.

In view of the remarks made yesterday — which are reported in the *Daily Journal* No. 3. We suggest the following wording for Summary 2, revised by Messrs. PUGSON, CHAN and BULLEID, which Mr. UYTBORCK will now read you:

**Mr. Uytborck.** — *Summary 2 :*

« 2. *One piece wheels* have been tested by many Administrations. They avoid tyre movement and in the case of carriages, railcars and motor coaches, the wheels can be lightened.

« The information on cost price of these and tyred wheels does not agree. It has to be remembered that the service conditions are different. »

*At yesterday's Meeting it was decided to omit the following sentence of the original summary, continuing by stating :*

« Heat treating of the tread is advised to get at least the mileage of tyred wheels or better, to exceed it. Increasing the resistance to wear and ultimately the

possibility of repairing the root of the flange by welding seem to be two benefits more readily obtained with one piece wheels. It appears desirable that the experience with one piece wheels be followed up. »

**The President.** — Do you agree to this text? *(Agreed.)*

*— Summary 2, modified in this way, was adopted.*

**The President.** — Gentlemen, the text of Summary 4 has been completely changed. Here is the suggested wording :

**Mr. Uytborck.** — *Summary 4 :*

« 4. Trials of *independent wheels* which have been carried out by several Administrations (L. M. R. of the British Railways, Italian Railways, Swiss Federal Railways) have often given rise to rapid and irregular wear of wheels of this type when used as guiding wheels. Definite conclusions regarding the advantage of independent wheels would require trials under other arrangements than those outlined in the Report. »

**The President.** — Does the Meeting agree to this wording? *(Agreed.)*

*— Summary 4, modified in this way, was adopted.*

**The President.** — *Summary 7 :* the first paragraph of this Summary has been altered and a new wording suggested.

**Mr. Uytborck.** — *Summary 7 :*

« 7. The upkeep of *parts subject to wear* is generally done by using detachable wearing plates.

« Interesting results have been reported :

« 1°) for articulated joints in general and in particular for brake rigging by the use of hardened or case-hardened steel bushes... »

**Mr. Chan.** — After further consideration of the replies received, I am wondering if it would not be advisable to complete the sentence :

« 1°) for articulated joints in general and in particular for brake rigging by the use of hardened steel bushes » by the words « or case hardened steel » because there are two types of bushes : those of hardened 60 kg steel — the type used on the British Railways — in which all the steel is of the same degree of hardness; and then the type, more or less in general use, of case hardened steel.

This is merely making sure that all the replies received are taken into account in the Summary.

**Mr. Uytborck.** — And we will not mention hardened steel therefore?

**Mr. Chan.** — No.

**Mr. Uytborck.** — In that case the words « acier trempé » will have to be omitted from the French text.

**Mr. Chan.** — They can be omitted.

**Mr. Uytborck.** — The French text will then be :

« 1°) pour les articulations en général et pour la timonerie en particulier par l'emploi de bagues en acier dur ou en acier cémenté. »

*(Signs of agreement from Messrs. Chan and Parmantier.)*

**The President.** — Does every one agree to the wording completed in this way by Mr. CHAN? *(Agreed.)*

— *This modification was therefore adopted.*

**Mr. Uytborck.** — The complete text of Summary 7 is therefore as follows :

« 7. The upkeep of parts *subject to wear* is generally done by using detachable wearing plates.

« Interesting results have been reported :

« 1°) for articulated joints in general and in particular for brake rigging by the use of hardened or case-hardened steel bushes;

« 2°) for axle box guides by the provision of the following :

« use of 13/14 % manganese steel *(British Railways);*

« use of plastic materials *(Italian State Railways* and *Metropolitain of Paris);*

« use of asbestos base material *(Norwegian Railways).* »

*The text of the second paragraph remains unchanged, as follows :*

« To improve stability and comfort, and reduce tyre wear, it is desirable to *prevent hunting as far as possible.* One way to achieve this is to avoid longitudinal play in the direction of the track between boxes and frame. Very varied methods of doing this have been used, which either reduce the effects of rubbing or suppress it :

« — adjustable or self-adjusting axle box wedges used especially on steam locomotives;

« — guides incorporating india rubber fastened to the frame;

« — axle box guides in the form of vertical cylindrical pedestals sliding in fitted cylinders (fig. 28, p. 1817/177, August, 1950, *Bulletin*);

« — axle boxes connected to frame by rods and silent block bushes (fig. 25, p. 1814/174, August, 1950, *Bulletin*) a solution used on several Railways;

« — boxes and frame connected by laminated springs placed longitudinally (fig. 30, p. 1826/186, of the August, 1950, *Bulletin*) a variant of the preceding arrangement. »

**The President.** — Do you agree to this wording? *(Agreed.)*

— *Summary 7, modified in this way, was adopted.*

**The President.** — Gentlemen this brings us to the end of our work for this morning.

Before adjourning the Meeting, I wish to thank the Delegates, the Reporters and Mr. CHAN, our Special Reporter, for their effective participation in these difficult technical debates which, thanks to your united efforts, have rapidly led to the evolution of clear and definite summaries.

I would also like to thank Mr. VELLEMAN, our interpreter, whose technical and linguistic abilities are so high.

Gentlemen, we meet again here on Monday October 2nd in order to discuss Question VI.

— The Meeting adjourned at 9.45 a.m.

# DISCUSSION AT THE PLENARY MEETING.

## Meeting held on September 29th, 1950.

DR. ENG. G. DI RAIMONDO, PRESIDENT, IN THE CHAIR.
GENERAL SECRETARIES : MR. P. GHILAIN AND DR. ENG. M. VALDIVIESO.
ASSISTANT GENERAL SECRETARY : MR. CH. E. WHITWORTH.

**The President** (in French). — We now deal with the Summaries of Question V.

**Mr. Ghilain,** *General Secretary* (in French). — The text of these Summaries appeared in the *Daily Journal of the Congress*, No. 3 of the 28th September and No. 4 dated 29th September 1950.

*(These Summaries raised no remarks.)*

**The President.** — We may therefore consider as adopted the Summaries of Question V.

### SUMMARIES.

« 1. *Tyre wear* determines generally « the mileage between repairs to the « running gear and frame.

« *Modern equipment,* that is the « stock provided with the improvements « mentioned in the report, has made it « possible to extend the mileage between « repairs with a more intensive utilisa- « tion and in certain cases an increase « in load and speed.

« *New rolling stock* is ordered for « various reasons : saving in working « costs, higher speed, greater safety, « more comfort. The saving in main- « tenance costs, whilst not the overriding « factor, enters into these reasons.

« 2. *One piece wheels* have been « tested by many Administrations. They « avoid tyre movement and in the case « of carriages, railcars and motor « coaches, the wheels can be lightened.

« The information on cost price of « these and tyred wheels does not agree. « It has to be remembered that the ser- « vice conditions are different.

« Heat treating of the tread is advised « to get at least the mileage of tyred « wheels or better, to exceed it.

« Increasing the resistance to wear « and ultimately the possibility of re- « pairing the root of the flange by weld- « ing seem to be two benefits more « readily obtained with one piece wheels. « It appears desirable that the expe- « rience with one piece wheels be fol- « lowed up.

« 3. To increase the mileage between « repairs and reduce wear with harder « rails some railways use *tyres* of 90 « kg/mm² (57.14 tons per sq. in.) qua- « lity.

« *Lubrication of the flanges or the*

« *rails* is desirable to reduce the reci- « procal wear of these two parts. Most « Administrations carry the lubricator « on the engine. Many and various « arrangements are used.

« 4. Trials of *independent wheels* « which have been carried out by several « Administrations (L. M. R. of the « British Railways, Italian Railways, « Swiss Federal Railways) have often « given rise to rapid and irregular wear « of wheels of this type when used as « guiding wheels. Definite conclusions « regarding the advantage of indepen- « dent wheels would require trials under « other arrangements than those out- « lined in the Report.

« 5. *Roller bearing boxes* tend to be « increasingly used in view of the reduc- « tion in hot boxes and the saving in « maintenance. In the case of steam « locomotives, the use of these boxes on « the driving and coupled axles or on « the driving axles only provides a « reduction in wear, resulting in an « important increase in mileage between « repairs.

« The few incidents reported in con- « nection with the journals can be « ascribed to these journals being too « small.

« In view of the high price of roller « bearing boxes, there are cases wherein « other types of box can be preferred.

« *When roller bearings are fitted* « *to electric locomotives and motor* « *coaches,* devices to prevent the electric « current from passing through the rol- « ler bearings are generally fitted.

« 6. Amongst oil axle boxes other « than of the classic type, should be « noted the boxes with mechanical oil « circulation, and on steam locomotives, « boxes with two brasses completely « surrounding the journal (British Rlys. « (S. R.) and S.N.C.F.).

« *Lubricator pads* of oil axle boxes « are improved by increasing the num- « ber of wool wicks and the use of wool « of special qualities.

« The tendency in Europe is to use « high tin *antifriction* metal for high « speed locomotives and rolling stock. « Rose metal or lead copper (Cu = 69, « Pb = 30, Zn = 1) is widely used on « the Italian State Railways on goods « wagons.

« These latter years, the tendency has « been to use thin coatings of white « metal not exceeding 3 mm (1/8″) « thick, but it is noted some Administra- « tions are going back to a rather greater « minimum of 5 to 7 mm (13/64″ to « 9/32″).

« 7. The upkeep of parts *subject to* « *wear* is generally done by using detach- « able wearing plates.

« Interesting results have been re- « ported :

« 1°) for articulated joints in general « and in particular for brake rigging by « the use of hardened or case-hardened « steel bushes;

« 2°) for axle box guides by the pro- « vision of the following :

« use of 13/14 % manganese steel « (*British Rlys.*);

« use of plastic materials (*Italian State* « *Rlys.* and *Metro. of Paris*);

« use of asbestos base material (*Norwegian Rlys*).

« To improve stabillity and comfort, « and reduce tyre wear, it is desirable « to *prevent hunting as far as possible.* « One way to achieve this is to avoid « longitudinal play in the direction of « the track between boxes and frame. « Very varied methods of doing this « have been used, which either reduce « the effects of rubbing or suppress it :

« — adjustable or self-adjusting axle « box wedges used especially on steam « locomotives;

« — guides incorporating india rub- « ber fastened to the frame;

« — axle box guides in the form of « vertical cylindrical pedestals sliding in « fitted cylinders (fig. 28, p. 1817/177, « August, 1950, *Bulletin*);

« — axle boxes connected to frame « by rods and silent block bushes (fig. 25, « p. 1814/174, August, 1950, *Bulletin*) « a solution used on several Railways;

« — boxes and frame connected by « laminated springs placed longitudinally « (fig. 30, p. 1826/186, of the August, « 1950, *Bulletin*) a variant of the pre- « ceding arrangement.

« 8. *Buckling springs* is generally « done hot. There is some extension in « Great Britain, and Switzerland, and « tests in France of the practice of « fitting the buckles on cold.

« *Spring steel* should be obtained « under such conditions that the same « heat treatment in the shops will pro- « duce constant results. This can be « got either by specifying the chemical « composition or by specifying given « characteristics to be obtained by a « predetermined heat treatment.

« *Coiled springs* should have their « surface free from defects. Some « Administrations (C. F. F., Norwegian « Railways) report fewer breakages with « springs of square and rectangular sec- « tion, than with round section bars.

« 9. *Rubber,* widely used on buffing « and drawgear is now being applied to « the spring gear and connecting mem- « bers between the body and frame of « tenders, electric locomotives, motor « coaches, railcars, and carriages.

[ 621 .337 ]

## QUESTION VI.

# Comparative study of transmission systems between motors and axles of electric locomotives, electric motor coaches and Diesel-electric railcars.

# Effect on the track of the types of bogies and systems of motor suspension.

### Preliminary documents.

Report (America [North and South], Burma, China, Egypt, Great Britain and North Ireland, Dominions, Protectorates and Colonies, India, Iran, Iraq, Malay States and Pakistan), by W. S. GRAFF-BAKER. (See *Bulletin*, April 1950, p. 543, and June 1950, p. 1145, or separate issue No. 13.)

Report (Bulgaria, Czechoslovakia, Finland, Greece, Hungary, Italy, Portugal and Colonies, Rumania, Spain, Turkey and Yugoslavia), by J. TAPIA. (See *Bulletin*, July 1950, p. 1529, or separate issue No. 32.)

Report (Austria, Belgium and Colony, Denmark, France and Colonies, Luxemburg, Netherlands and Colonies, Norway, Poland, Sweden, Switzerland and Syria), by Ch. HOFFET. (See *Bulletin*, August 1950, p. 1633, or separate issue No. 34.)

*Special Reporter :* Ch. HOFFET. (See *Bulletin*, October 1950, p. 2069.)

## DISCUSSION BY THE SECTION.

## Meeting of the 2nd October 1950.

President : LORD HURCOMB.

— The Meeting began at 9.30 a.m.

**The President.** — Gentlemen, to-day we will begin our examination of Question VI: *Comparison of the different types of transmission between motors and axles of electric locomotives, electric motor coaches and Diesel-electric railcars. Effect on the track of the types of bogies and systems of motor suspension.*

I call upon the Special Reporter to begin.

**Mr. Hoffet,** *Special Reporter* (in French). — Mr. PRESIDENT, Gentlemen, the special report for Question VI has four summaries only.

May I remind you that the object of the first part of Question VI was to

reconcile diametrically opposite points of view expressed last year at the Enlarged Meeting of the Permanent Commission at Lisbon, concerning in particular the method of driving the motor axles. As there were no acceptable technical reasons to explain these divergencies, we considered it advisable to recall in Summary 1 the fundamental principles limiting the builder of rolling stock.

Taking into account the traditions and industrial and economic possibilities of the different countries, as well as appreciating the importance of the purchase price and maintenance costs of rolling stock, it seems natural to us that even in the case of such important components as the axle drive, opinions are very much divided. As these designs are still being evolved, no progress would be possible without such divergencies of opinion.

The reports showed that each railway endeavours to find the solution which owing to its special conditions, seems to it the most economical, whilst respecting the old adage : « Safety first ».

The three reporters agreed together the other summaries which will be discussed to-day.

*Summary 1 :*

1. The construction of railway rolling stock in general and of motored vehicles in particular is limited by :

*a*) the loading gauge;

*b*) the permissible axle load;

*c*) the materials available;

*d*) the cost of construction;

*e*) the cost of maintenance, inspection and repair.

**The President.** — Gentlemen, this Summary is open to discussion.

**M. Parmantier,** *French National Railways* (in French). — Summary No. 1 of the special report mentions a number of things which whilst pertinent to the subject raise the question if it should be retained. It treats with a question not quite that on the agenda. It in fact relates to the transmission and covers moreover all rolling stock in general. Personally, I am inclined to the suppression of Summary No. 1.

**The President.** — I should like to know the opinion of the Meeting on this.

**Mr. d'Arbela,** *Italian State Railways* (in French). — I support Mr. Parmantier's view because as formulated the Summary is not really complete and this because first of all it does not fall within the limits of the question now under discussion.

It is incomplete because another idea of limitation is given by the tractive effort at the drawbar hook. This depends upon the rolling stock making up the train and is one of the fundamental factors of the problem before us when deciding the choice of a locomotive.

**Mr. Hug,** *Bernese Railways, Switzerland.* — May I suggest that we take Summary No. 1 as an introduction to the three subsequent summaries. It seems to me it is useful to repeat these considerations briefly and if need be as proposed by Mr. d'Arbela add to them reference to the allowable tractive effort.

**Mr. Baeyens,** *Belgian National Railways* (in French). — In my opinion if the text of Summary No. 1 be retained we should

add a reference to the maximum speed which is also an important factor seeing that the methods of construction and the type of the rolling stock vary widely according to whether high speed or slower speed rolling stock is in question.

**Mr. Bulleid,** *Coras Iompair Eireann, Ireland.* — I would suggest that this conclusion be put in rather as part of the factors governing the design; to elaborate them in more detail would make them very lengthy and serve no very useful purpose. I suggest that Mr. PARMANTIER is quite correct in stating that they are not summaries but statements of certain design factors.

**Mr. Hoffet.** — Gentlemen, I think that Summary 1 is fundamentally common ground. It is not necessary to include all these considerations in Summary 1, but it is a good thing to have a text like the one put before you to-day from time to time, at least in the form of an introduction, alluding to the difficulties continually experienced by the designer of rolling stock. In effect the limitations in question are easily overlooked when building rolling stock. In addition, what we are saying here is not only intended for the designers of rolling stock but also for the engineers of other departments, the Permanent Way for example.

I think we can assent to Mr. HUG's suggestion and take this paragraph as an introduction to the summaries, completing it however by the reference to « the maximum speed » as Mr. BAEYENS has just suggested.

**The President.** — I think that the Section should now decide whether this Summary is to be retained in its present form or is only acceptable on condition it is no longer called a « summary » but is taken as a collection of introductory sentences, including the allusion to the maximum speed and the other matter mentioned by Mr. D'ARBELA. Is it your general opinion that this text should be retained but not as a summary?

**Mr. d'Arbela.** — I have not changed my opinion.

**The President.** — What is the opinion of the majority of delegates? Shall we suppress it completely? I think that the majority are in favour of suppressing it purely and simply. Is that right? How many wish to retain it as an introduction to the summaries, and how many wish to suppress it completely?

*— A vote was taken by a show of hands on the question of retaining the text of Summary 1 not as a summary, but as part of the introduction. This was agreed by 15 votes against 12, in favour of suppressing it purely and simply.*

**The President.** — Summary 1 is therefore no longer to be taken as a summary, but as part of the introduction, being completed to take into account the remarks made by Messrs D'ARBELA and BAEYENS.

The Section agreed to the following text :

INTRODUCTION.

« The construction of railway rolling stock in general and of motor vehicles in particular is limited by :

« *a)* the loading gauge;

« *b)* the permissible axle load;

« *c)* the materials available;

« *d)* the cost of construction;

« *e)* the cost of maintenance, inspection and repair;

« *f)* the maximum speed;

« *g)* the tractive effort. »

**The President.** — We now come to Summary 2, which becomes the new *Summary 1 :*

**Mr. Hoffet.** — *Summary 2 :*

2. There are a number of different transmission systems which can be used for all speeds up to 150 km/h. and for horse powers up to 1 500 per motored axle. The choice of these will be dictated by local conditions :

*a*) if the track is sufficiently robust and well maintained, nose suspension may be used without great disadvantage;

*b*) if the track is weaker, it is desirable to use one of the systems employing resilient transmission and frame mounted motors if possible.

It should be noted that nose suspension inevitably causes lateral shocks to the track by reason of the unsprung weight of the motor. The progressive wear of rail and flange only aggravates the trouble.

**The President.** — Before beginning the discussion, I would like to point out an error in the translation. In the English text it is stated in paragraph *a)* that nose suspension can be used « without great disadvantage » (sans grand désavantage), whereas the French text states : « la suspension par le nez peut être utilisée sans inconvénients ». I think the word « great » (grand) should be left out of the English text, and would like to know what the British delegates think about this ?

**Mr. Lynes,** *British Railways.* — The word « great » in the English text has such a big bearing on the paragraph that I think it would be better if it were deleted.

**Mr. Graff-Baker,** *Reporter.* — I think this English idiom is incapable of translation into French.

**The President.** — The English text should correctly translate the French text. The French delegates say that this can be done without inconvenience.

**Mr. Maas Geesteranus,** *Netherlands Railways.* — I think it would be better to add the word « grand » to the French text.

**Mr. Tapia,** *Reporter.* — I think the French text should be left as it is.

**Mr. Parmantier.** — A solution which should please everyone would be to leave out the words « sans inconvénients » (without disadvantage), so that the paragraph would end with the words : « nose suspension may be used ».

**Mr. Leduc,** *French National Railways* (in French). — I was just going to make this point in the name of Mr. Robert LÉVI, Directeur du Service technique des Installations fixes de la S. N. C. F.

To make his idea quite clear, I think it will be better to read you the note he sent me, in which Mr. Robert LÉVI says :

« Reading the reports one learns nothing positive about the dynamic effects in the vertical direction due to nose suspended motor axles.

« For my part, I think that as electric locomotives have a relatively great unsuspended weight they are not systematically more destructive than other engines on account of their transverse oscillations, but it is quite otherwise in the case of the vertical efforts. It seems to me that to decide this latter point, the railways concerned should undertake very exact trials by means of equipment capable of showing vibrations with a frequency of more than 100 periods per second. If such trials have already been made, it would be useful to quote them.

« The information collected on this question, apart from that relating to the transverse efforts, is all mixed up in the reports and cannot be accepted without taking into account the conditions governing the replacement of rails and the control of the condition of the rails practiced on the different railways.

« On some railways the rails are frequently renewed and coaches specially equipped to detect transverse cracks are run over the lines periodically. This practice should perhaps be made the general rule on electrified lines where fast trains are hauled by locomotives with nose suspended motors.

« It is wrong therefore to state that they can be used without disadvantages.»

On the French railways our impression is that the effect of nose suspended motors is quite considerable as regards rail breakages, but without being able to define it very precisely. It does not seems therefore that both words « sans inconvénients » (without disadvantages) can be maintained without correction.

**Mr. de Sousa,** *Railway Board, India.* — We have had some experience in connection with motor coaches on the Great India Peninsula Railway. For a long time, we were troubled with the excessive wear in rails in sinusoidal form, and we tried to discover the cause of this. We suspected a number of possibilities and finally decided to carry out certain experiments for this purpose on motor coaches. We had a very clever electrical engineer who gave us a number of points where readings could be taken on the motor. We had altogether about 12 to 15 pens working, indicating the various motions of the bogie as it ran on the track. The final conclusion that we came to and which got us over this particular form of wear in the rails was that we reduced to the very minimum any slackness in the bogie suspension and in the axlebox clearances. In the bogie bolster suspension we went as far as 1/32'' on either side, and thought at first it would not be possible to arrive at 1/16'', 1/32'' on either side, and the clearances had to be exact at all points and machined to this high level. The result was that we have practically overcome this excessive wear in our rails in a sinusoidal form, and I, therefore, think that, in addition to what has been stated here, it is particularly important after this experiment we carried out, to introduce the fact that all clearances, whether in the bolster or in the axleboxes, should be reduced to the very minimum, in order that the effect of lateral play to nose suspension may be reduced to a minimum.

**Mr. Read,** *New Zealand Government Railways.* — I appreciate the point made. Actually, the statement (a) is quite true as it stands : that, if the track is robust, then you can use nose suspension motors

whatever the amount of play. I think we have two views on this matter, and the conclusion should be reworded so as to bring in the relation between the robustness of the track and the clearances or degree of maintenance necessary in the suspension system. If the track is very robust, then you can have quite a lot of play in your suspension, but, if the track is weak or the suspension is badly maintained, you need closer clearances. Those two factors should be related in the wording of the Summary.

**Mr. d'Arbela.** — I would like to make two comments.

First of all mention is made in the first paragraph of a maximum speed of 150 km/h (93 m. p. h.). I think this figure should be changed, as on several European Railways, speeds of up to 160 km (100 m. p. h.) and over are the current practice.

My second comment is the following : I think mention should be made of the stresses due to the vertical dynamic effects, besides the lateral effects.

I share the opinion expressed in the name of Mr. Robert Lévi, as I believe that the vertical effort due to the suspension of the motors is more important in its two components — a vertical component and a component tending to rotate the axle — than the stresses due to the lateral dynamic effort.

As for the observation made by Mr. de Sousa, I think that it should be taken into account in Summary 3 rather than in Summary 2.

**Mr. Leduc.** — I confirm what Mr. d'Arbela has just said. What we are particularly concerned with, are the oscillations due to very high frequency vertical stresses, about which we have not a very great deal of information whereas on the contrary the lateral effects of the lateral vibrations which affect the wear of the rails have not, as far as we know, a determining influence on the use of nose suspended motors.

**Mr. de Sousa.** — I want to make it quite clear what I have been speaking about is motor coaches and electric locomotives. Regarding the point raised by one of the British delegates, the wear that took place on our rails and of which I have spoken, was on our best maintained and most robust section of the track out from Bombay for a distance of about 34 miles. This track is 100 lb. bull-headed rails and is maintained well, as it is closest to the headquarters. In spite of the track being in the best maintained condition and the weight of the rails, and in spite of tightening all factors before we got down to the actual cause, we found that this problem of wear was caused by the slack clearances more than by any other factor.

**Mr. Hoffet.** — Gentlemen, as far as this point is concerned, I must call attention to the unfortunate effects of the mass of the motor on the track, from which we have nothing to fear in the case of a light motor of about 50 to 100 H.P. because in this case it is only a question of small masses. But when we come to larger motors, nose suspended, we have, according to the reports received, the impression that opinions are divided on this subject. We cannot fix an exact limit

for all the countries of the world or for all the railways. The limit for one type of motor will be sufficient for one railway and not for another.

For this reason we thought it advisable to suggest saying : « nose suspension may be used without disadvantages » because we cannot say — and I do not think anyone can say — that the nose suspended motor never has a bad effect on the track. We can leave this out altogether and make no mention of it. But to leave out the words « without disadvantages » is to bar the way to any discussion on the subject.

Another point raised by Mr. D'ARBELA concerns the speed. In our report, we did not mean to imply that speeds of 180 to 200 km (112 to 124 miles)/h. are impossible. In its broad outlines the report is a guide; it ought not to mention only records which can be reached in trials, but first and foremost a good average speed which can be discussed.

We had to give some idea of the speed, and in view of the difficulties and also the diversity of opinions revealed in the different reports, we limited it to 150 km (93 miles)/h. No one can say that at such a speed one or other type of motors, nose suspended or completely suspended, is unsuitable. Up to this speed of 150 km/h., it is possible, in the opinion of each of the railways, provided the powers are not too high, to use either method of suspension.

On the other hand, if much greater powers are required, we know that the completely suspended motor allows of horse powers of 1 500 and 1 800 if necessary, but, I must repeat, this only applies to completely suspended motors.

The object of our report is not to say what is happening in the different regions, but to give a general idea.

**The President.** — The Special Reporter proposes that the word « great » be retained in the English text and a similar word added to the French text, in view of the fact that it is impossible to affirm that there are no disadvantages at all, which the French text might seem to imply if left as it is.

**Mr. Parmantier.** — I am in complete agreement with the remarks just made, but I wonder whether for the sake of clearness in the text, it would not be better to divide Summary 1 into several paragraphs. The first would consist of the first five lines of the text, i. e.: « There are a number of different transmission systems which can be used for all speeds up to about 150 km/h and for horse powers up to 1 500 per motored axle ».

The second paragraph would specify that nose suspended motors cause vertical and lateral shocks to the track. This is a fact which is not sufficiently clearly indicated, and I think it should be pointed out.

Then there would be a third paragraph indicating the possible choice between nose suspended and completely suspended motors.

If you will allow me, I would like to add yet another comment : in the second paragraph we might make an allusion to the interest attached to making scientific measurements in order to ascertain exactly the stresses caused by nose suspended motors.

**Mr. Cuttica,** *Italian State Railways* (in French). — I would like to insist on the fact that there are electric motor coaches for which a speed of 150 km/h is not exceptional; in fact before the war, it was quite usual. When the lines allow it run at a normal speed of 160 km (100miles)/h is also possible. To state to-day that one can go up to 150 km/h amounts to saying that a speed of 160 km/h for example may cause incidents, and disadvantages, which is not true.

**Mr. Hoffet.** — Regarding this last remark, I think that a slight modification might be made to the text, by replacing the words « speeds up to 150 km/h » by : « speeds up of about 150 km/h ». In this way, there is an allowable margin, which takes Mr. Cuttica's remark into account.

I would now like to return to Mr. Parmantier's suggestion, of altering the order of the paragraphs in Summary 1.

I am in favour of this suggestion; it makes the wording more logical and makes the matter clearer to the reader.

We will therefore begin by mentioning the different types; then we will explain that the suspension leads to certain disadvantages as regards the track, etc., and finally — and I quite agree on this point — we will suggest making further trials.

I also intended to indicate in the general summaries that it would be a good thing to combine or co-ordinate the different trials carried out by various railways, as well as in the laboratories, in order to study the behaviour or running of the vehicles on the track.

From time to time the technical press publishes extremely interesting articles giving the results of very thorough trials carried out by a few specialists. It would be a very good thing if such trials could be made more general and the idea of them propagated. This is very important work which the general public never gets to know about — though there is no need for them to know about it in any case — but it would be desirable for the specialists at least to be up to date in the matter.

When we drew up our summaries, the reporters unfortunately could not agree about the need of making such trials public and co-ordinating them, as I should have liked to do. I know very well that some railways are going into this matter very thoroughly. We might mention the S. N. C. F. for example, which is carrying out extremely interesting trials, the results of which are obviously not accessible to anybody. The Netherlands Railways also have carried out very far reaching experiments on the subject of the running of vehicles on the track and the reactions due to running through curves, etc.

I think it would be advisable to complete this Summary by suggesting co-ordinating trials of this kind, and I am very obliged to Mr. Parmantier for raising this point.

However, in view of the fact that we are at a meeting which has to decide the wording of the summaries, I would like to ask the President to put this suggestion to the vote.

We will then give the possibilities of using them, which are already stated in *a)* and *b)*.

**The President.** — What wording exactly do you suggest, Mr. Hoffet? Would you be good enough to give the exact text you wish to submit to the vote?

**Mr. Hoffet.** — I suggest the following wording :

« There are a number of different transmission systems which can be used for all speeds up to about 150 km. per hour and for horse-powers up to 1 500 per motored axle.

« Nose suspension inevitably causes lateral shocks to the track by reason of the unsprung weight of the motor. The progressive wear on rail and flange only aggravates the trouble. It is desirable to undertake trials for measuring the efforts exerted on the track by different systems of suspension of the motors.

« Choice between the different systems of transmissions will be dictated by local conditions :

« *a)* if the track is sufficiently robust and well maintained, nose suspension may be used without great disadvantage;

« *b)* if the track is weaker, it is desirable to use one of the systems employing resilient transmission and frame mounted motors if possible. »

**The President.** — Regarding the second paragraph, are we agreed that the *vertical* shocks as well as the lateral shocks should be mentioned, the word « vertical» coming first? Does this satisfy you Mr. GRAFF-BAKER?

**Mr. Graff-Baker.** — Yes.

**Mr. Hoffet.** — The text should be completed in this way.

**Mr. Chan,** *French National Railways* (in French). — I think it was merely an oversight.

**Mr. Hoffet.** — Yes.

**The President.** — Gentlemen, do you agree to the words « *vertical* and lateral shocks »?

**Mr. Hoffet.** — The sentence in question will therefore read :

« Nose suspension inevitably causes vertical and lateral shocks to the track by reason of the unsprung weight of the motor. »

**The President.** — Does this wording meet with your approval? *(Agreed.)*

We will reconsider the exact wording at to-morrow's meeting. I do not propose to spend any more time on a matter of a few words. Naturally, if there are any fundamental points to be settled, we will discuss them.

**Mr. Graff-Baker.** — Agreed.

**Mr. Leduc.** — In paragraph *a)* I want to go back — if I may be excused for doing so — to the words « without disadvantages ». The suggested addition can be accepted, saying « without great disadvantages », but could not this be completed by the words : « for low powers » or « for moderate powers ».

I think that this would agree with what was said just now by the Indian delegate and the Special Reporter.

**The President.** — This is really a new idea. We cannot go on and settle it without a more extended discussion. I hope Mr. LEDUC will not insist upon the point.

**Mr. Leduc.** — I am sorry for prolonging the discussions, but in making my comment on this point, I thought I was accepting the invitation made by the President.

To state that nose suspended motors can be used « without disadvantages » or « without great disadvantage » means more or less the same thing.

According to the wording of the Summary, the use of nose suspended motors is only conditional to the constitution of the track, whereas it as stated just now that other factors — particularly the horse power — affected the choice of transmission system.

**The President.** — Naturally anyone can make suggestions regarding the fundamental points of the question; our object in meeting here is to discuss it. But when after a long and difficult exchange of opinions, a new point is raised, there is a risk of unsettling the whole matter again.

**Mr. Leduc.** — I will not insist upon it, Mr. PRESIDENT, in view of the fact that the Report of the Meeting will include my comments, so that they can be taken into account if necessary.

**The President.** — Can we now go on to the following summary in view of the fact that the final text of Summary No. 1 will be given in to-morrow's *Daily Journal*, so we shall be able to see the final wording before to approve it? *(Agreed.)*

**Mr. Hoffet.** — *Summary 3 (new No. 2) :*

3. In order to avoid severe vertical shocks to the track due to high speeds it is necessary to fit a resilient suspension system between the bogie and the body of locomotives by the use of arrangements similar to those long used on coaching stock and railcars. On locomotives, transverse linkages between bogies are tending to become general :

*a*) in order to reduce side wear on the track and flange wear, especially on curves;

*b*) in order to reduce hunting on straight track.

**Mr. Chan.** — Mr. PRESIDENT, in the first lines mention is made of shocks due to increasing the running speed. As we have just dealt with vertical and lateral shocks, the kind of shocks in question here should be defined. I think it is a question of lateral shocks. If the Reporter agrees, we might say : « To avoid the harmful effects on the track of *lateral* shocks... ».

**The President.** — Only vertical shocks?

**Mr. Chan.** — I do not think it is question of vertical shocks, but rather lateral shocks. As mention is made of elastic components, I thought it meant the bolsters.

**Mr. Graff-Baker.** — I think it is quite clear that shocks are of both kinds, and if we cover both kinds in one, we should cover both kinds in every bogie, as vertical and lateral shocks occur in all bogies as they are built that way.

**Mr. Hoffet.** — Gentlemen, I think it is necessary to mention the vertical and the lateral shocks because we have not only to consider the bogie in itself, but also the other kinds of electric locomotives

which we knew when there was only a single rigid frame. A few years ago, when the speed of running through curves was increased, a great many calculations were made, all extremely theoretical, and in my opinion rather over-simplified, based on the idea — to my mind erroneous — that only the weight or load per axle affected the track, and the amount of magnitude of the shocks. It is naturally understood that whilst we are working on absolutely theoretical conditions of construction of vehicles, we can, if we only take a body or set of wheels with a load of 20 tons for example, obtain a certain centrifugal force. This centrifugal force exerts an influence on the track. Nobody can dispute the fact. But in addition, there is also the fact that the axle in itself, according to the way it is attached to the frame of the vehicle, will not behave in the same way if it is question of a rigid framed vehicle which works in a certain way, or a vehicle with bogies, or even axles which adjust themselves to the track.

In Switzerland, we have made some calculations based on this idea. With a load of 20 tons per motor axle, we take a speed of 100 km (62 miles)/h for example for a curve of 580 m (635 yards) radius. We calculated the load per axle required to give the same centrifugal force upon the track. This worked out at 13 tons for a speed of the order of about 110 km (68 miles)/h.

When these calculations were made, no account was taken of the fact that at the time we had some locomotives with rigid frames, and owing to the fact that these locomotives have been replaced, when it was a question of higher speeds, by bogie locomotives whose axles better adjust themselves to the track and with which other effects which occur in the transmission, between the body and the axle, even if the centrifugal force is reduced, can neutralise part of the harmful effect due to the rigidly mounted axle.

I think that for this reason there is no need to specify whether it is question of lateral or vertical shocks, but that it would be better to speak of shocks in general. In addition, as the wording should be as brief as possible, I would prefer to leave these adjectives out.

**Mr. d'Arbela.** — I think that the existence of some elastic method or the possibility of lateral movement in the bogie cannot fail to have a favourable effect upon the vertical stresses of the track, as they help to increase the space factor — if we may so call it — in the transmission of energy by the shock. Thus they decrease the force factor and the stress factor.

**Mr. Baeyens.** — I think that it might improve matters if we said : « on the locomotives, the traverse couplings between bogies tend to become general... ». I am not overlooking the fact that at the present time trials are being carried out on various railways with engines built on new lines, but if we estimated the number of engines on which such methods had been used and compared this figure with the total number of electric locomotives owned by the different railways, I think that the percentage would be very small. Consequently I think that the words « tend to become general » are rather strong.

**The President.** — We can go back to this point later. We must first decide the first part of the Summary. The general opinion seems to be that we should mention vertical and lateral shocks in both texts, or else not put the word « verticaux » in the French text, since it is not mentioned. You prefer to mention them both dont you Mr. Hoffet?

**Mr. Hoffet.** — I am in favour of merely putting « shocks ». In order to shorten the text, I prefer to leave out the adjectives.

**The President.** — The French text presents no difficulties, and we can leave out the only adjective in the English text, i. e. « vertical ».

**Mr. Chan.** — To make the text clear, I would like to ask the Special Reporter what arrangements the report has in mind when speaking of « arrangements similar to those used on coaching stock and railcars ». Does this mean swing bolsters, elastic centering devices?

**Mr. Graff-Baker.** — I think the word « bogie » in the second line of the French text is not quite the right word. It is the resilient suspension between the axlebox and the body of the locomotive; in other words, the traction bogie for locomotives is similar to those used on coaching stock, and suspension starts from the axleboxes and extends to the body.

**Mr. Bulleid.** — Between the axleboxes and the body of the locomotive.

**The President.** — The French text says « between the body and the bogie », and Mr. Graff-Baker suggests that it should be between the axleboxes and the body, which would cover the meaning in English, and, I think, in French it would be more accurate.

**Mr. Bulleid.** — If you put « axleboxes » or « body » it would be correct; axleboxes instead of bogie.

The French text would be better if we removed the word « axlebox » as we now have it, and insert the word « axles »; this would be better and also in the English text.

**Mr. Graff-Baker.** — I agree.

**Mr. d'Arbela.** — I think that the innovation reported here consists precisely in the fact that for some years use has been made of elastic components enabling the body to move laterally in respect to the bogie. It is not a question therefore of the elastic part between the axle box and the first frame, but rather of components exactly like those used for a great many years in the case of coaches, which allow the body to have plenty of movement relatively to the frame below the body.

Under such conditions shocks, both vertical and lateral, frequently occur.

**Mr. Hoffet.** — They are absorbed.

**Mr. d'Arbela.** — They are not absorbed, but rather distributed more widely on the curves. It is therefore important to retain this particular remark.

**The President.** — I would like to know the exact wording proposed for the modification to the first paragraph.

**Mr. d'Arbela.** — I do not wish to make any change.

**Mr. Tapia.** — I agree with Mr. D'ARBELA.

**The President.**— In English, apparently, it is not quite accurate.

**Mr. Hoffet.** — I think that with merely a slight alteration we can keep the text as submitted to you, because it takes in account everything suggested by the various Delegates. We might say :

« To avoid the harmful effect on the track of shocks due to increasing the speed, it is necessary in the case of electric locomotives to use bogies with a resilient suspension system between the body *and the axle*. »

In this way we have on the one hand « between the body and the bogie » and on the other « between the bogie and the axle » itself, so that, I think, by saying « between the body and the axle » we have got all that is needed.

Then comes : « arrangements similar to those long used *on other vehicles* » so as to take into account steam locomotives as well as coaches and railcars.

If we mention other vehicles here, we must not simply mention locomotives, but electric locomotives, without any danger of thinking it also applies to steam locomotives.

We can therefore say :

« It is necessary in the case of *electric* locomotives to use bogies with a resilient suspension system between the body *and the axle*, similar to those long used on other vehicles. »

I think that this wording takes all the opinions expressed into account.

**Mr. Bulleid.** — That would be accepted for the English text.

**Mr. Graff-Baker.** — Yes.

**Mr. d'Arbela.** — I do not think it is sufficient to say « resilient suspension system between the body and the axle » but it should also be made clear that their object is to allow of lateral movements of the body. In effect it is the lateral movement of the body which is the essential point. To say that elastic components are needed between the axle and the body is rather an obvious statement; everyone knows of course that there are elastic components between the body and the axle.

**Mr. Hoffet.** — Agreed.

**The President.** — This brings us back to the point at which we started, namely whether it is correct to speak of the body or the axles.

**Mr. Graff-Baker.** — I think that we are really talking about two things of different character at the same time. In the first place there is the vertical and lateral suspension for ordinary riding of the vehicle. In the second place there is the point now raised regarding the prevention of bogies from hunting under the body; that is a somewhat separate problem. It is not usual on carriage stock to make such an arrangement, which, however, it is becoming a necessary and normal practice to fit on locomotives.

**The President.** — There are real differences of opinion, and the difficulty is to try and say two different things in the same word. Are there any views on the proposal from Mr. Graff-Baker?

**Mr. Graff-Baker.** — The English text speaks of resilient suspension between axles and the body of the locomotive by the use of arrangements similar to those used on coaching stock. One could say « by the use of arrangements similar to those long used on other vehicles » and in addition « by means of controlling the hunting of bogies ».

**Mr. Cuttica.** — I think that the wording suggested by the Special Reporter is the best because it really does give some idea of the interesting innovation which consists in introducing a system of suspension very similar to that used on coaches and railcars. This is the important fact. M. Hoffet's text in my opinion is the clearest; it is also that which really defines this method of suspension.

**Mr. Chan.** — In fact the Italian delegates wish to draw attention to the lateral elastic devices between the frame and the bogies, i. e. the swing bolsters of coaches, whereas the English delegates want to call attention to the fact that there is something else, namely there are also elastic devices between axles and body, between the axle boxes.

We might perhaps reconcile these two points of view by specifying that although this is the most interesting method, it is not the only one which will prevent harmful effects in question. If we say : « In order to prevent the harmful effects on the track due to shocks caused by increasing the speed *in particular* it is necessary... » this would not mean that this is the only method — « to fit a resilient suspension system ». This is in fact the point to which we wish to call attention. « It is necessary *in particular* » would be inserted in the third line. We might also say « there is interest in particular in using... », etc.

**Mr. Squilbin,** *Belgian National Railways* (in French). — I think that Mr. Chan's proposal did not concern elastic connection — which have not been used for any length of time — between the axle box and the bogie itself. If only the swing bolster is mentioned, only lateral movements of the frame from the bogie-swing bolster are concerned, and not those which may occur — and which do now occur — between the boxes and the bogie frame itself. I think this also should be mentioned.

**Mr. Chan.** — If no mention was made of it, it was in order to prevent the text being too long and merely retain the most important point. I agree with you in saying that this solution is being tried out at the present time, but it is not general.

**Mr. Squilbin.** — There are different applications and there are several systems which it is good to mention.

**Mr. d'Arbela.** — I would like to suggest an alteration to the text.

After the words : « To prevent the harmful effect on the track of shocks due to the increased speed, it is necessary to

fit a resilient suspension system on locomotives between the body and the bogie ». I would like to add : « or else between the frame and the axles », and continuing : « arrangements which *are often* similar to those long used on coaching stock and railcars ».

**The President.** — I think we had better ask the Special Reporter to discuss the text with those who have spoken this morning and see whether they cannot agree some words in English and French which will harmonise the different points of view. Of course, if it is not possible for the Special Reporter and the others to put into the same words two quite different ideas, and if we really cannot agree, then the two separate points of view may have to be studied separately. I think the discussion has brought the Section a good deal nearer agreement and, if we can give the subject a little attention after this Meeting, I think we can reach a solution. On the last sentence of the conclusion, you question the word « tending »; what would you say?

**Mr. Baeyens.** — What I wanted to say just now was that in my opinion it is rather too early to affirm that « transverse linkages between bogies are tending to become general ». Actually although certain railways are now carrying out trials, it should not however be forgotten that compared with the total number, the percentage of engines with transverse linkages is, if I am not mistaken, extremely small. It seems to me therefore that it is an exaggeration to say that they are tending to become general.

**The President.** — What do you suggest to replace this text?

**Mr. Hoffet.** — Mr. PRESIDENT, I do not entirely agree with the suggestion of the representative of the Belgian Railways. In fact in Switzerland alone we already have more than 150 electric locomotives out of 500, i. e. about one third, which have been fitted with transverse linkages for more than thirty years. We have also been obliged to fit the motor coaches in this way in order to reduce the wear on the tyres. This is the only reason why we do it.

But I cannot only speak about Switzerland; I was also obliged to take into account what was being done in other countries according to the reports. We found that transverse linkages everywhere — whether fitted with a connecting rod, or simply coupling up the tender and locomotive — were tending to be used generally everywhere. This does not mean that they are being introduced everywhere, certain railways were more reticent than others, but if we study for example what is being done on the American railways, we see that already for quite a long time such linkages are being used and will continue to be used.

Under these conditions, we cannot say that there is not a certain tendency towards generalisation. It is quite clear that in the reports as drawn up mention was made of generalisation, which does not mean that it is 100 %, but we can affirm that 50 % — perhaps even 60 % — are fitted with such linkages.

**Mr. Cuttica.** — I think we might replace the word « tend » by « have a certain tendency », as the Special Reporter suggested.

**Mr. Parmantier.** — Although in France we have such linkages between bogies on goods locomotives running at low speeds, i. e. up to 105 km (65 miles)/h, we have no such linkages between bogies on our recent express locomotives which run at 160 to 170 km (100 to 105 miles)/h, and experience has proved that there is no wear of the flanges.

To-date these locomotives have run more than 300 000 km (186 000 miles) and there have been no incidents nor any difficulties.

In view of this, in order to satisfy Mr. Hoffet and to make the Summary reflect the opinions of the different Administrations could we not say : « are tending to become general *in some countries* » ?

**Mr. Hoffet.** — I agree.

**The President.** — In the French text we would therefore say « tendent » or « ont une certaine tendance à se généraliser... ».

**Mr. Chan.** — « Tendent »

**The President.** — « ... tend to become general in certain countries ».

Do you agree? *(Agreed.)*

The final wording of *Summary 2* will be submitted to you for approval at to-morrow's Meeting.

We now come to the *new Summary 3* (old Summary 4).

**Mr. Hoffet.** — The *new Summary 3* is worded as follows :

4. The operating conditions with steam and electric traction differ too much from one another to permit a reasonable comparison of track maintenance costs to be made.

**The President.** — Do you agree? *(Agreed.)*

— *The new Summary 3 is adopted.*

**The President.** — Gentlemen, this brings us to the end of our work for to-day.

We will meet again to-morrow morning at 9 o'clock in order to agree the final wording of the points left over to-day, i. e. Summaries 1 and 2.

— The Meeting adjourned at 11.45 a.m.

## Meeting of the 3rd October 1950.

President : Lord Hurcomb.

— The Meeting began at 9 a.m.

**The President.** — Gentlemen, may I remind you that to-day we have to examine the new text suggested for Summaries Nos. 1 and 2.

**Mr. Uytborck,** *Principal Secretary.* — Here is the wording decided upon for *Summary 1 :*

« There are a number of different transmission systems which can be used

for all speeds up to about 150 km per hour and for horse-powers up to 1 500 per motored axle.

« Nose suspension inevitably causes vertical and lateral shocks to the track by reason of the unsprung weight of the motor.

« The progressive wear on rail and flange only aggravates the trouble. It is desirable to undertake trials for measuring the efforts exerted on the track by different systems of suspension.

« Choice between the different systems of transmissions will be dictated by local conditions :

« *a)* if the track is sufficiently robust and well maintained, nose suspension may be used without great disadvantage;

« *b)* if the track is weaker, it is desirable to use one of the systems employing resilient transmission and frame mounted motors if possible. »

**The President.** — Are you agreed on this text?

**Mr. Parmantier.** — Mr. PRESIDENT, I quite agree as far as the text is concerned. I am simply wondering if, for the sake of clearness, it would not be better to put *a)*, *b)* and *c)* in front of the first three paragraphs.

**The President.** — It is not the custom to number all the sentences. However if everyone agrees, we can adopt Mr. PARMANTIER's suggestion.

**Mr. Uytborck.** — So long as there is no alteration of the text, it can be decided by the Office.

**Mr. Parmantier.** — I think the text is quite all right.

**The President.** — No comments?

*Summary I* will therefore be worded as follows :

« 1. *a)* There are a number of different transmission systems which can be used for all speeds up to about 150 km per hour and for horse-powers up to 1 500 per motored axle.

« *b)* Nose suspension inevitably causes vertical and lateral shocks to the track by reason of the unsprung weight of the motor. The progressive wear on rail and flange only aggravates the trouble. It is desirable to undertake trials for measuring the efforts exerted on the track by different systems of suspension.

« *c)* Choice between the different systems of transmissions will be dictated by local conditions :

« if the track is sufficiently robust and well maintained, nose suspension may be used without great disadvantage;

« if the track is weaker, it is desirable to use one of the systems employing resilient transmission and frame mounted motors if possible. »

**Mr. Baeyens.** — I think there is some difference between the French and English texts. In the second paragraph of the French text it says : « ... the efforts upon the track of the different systems of suspension of the motors », whereas the English text merely says « different systems of suspension » and not « different systems of motor suspension ».

**Mr. Uytborck.** — Obviously it is not the same thing; we will alter the *English text*.

**The President.** — I suggest completing the English text by adding « suspension of the motors ».

Do you agree? *(Agreed.)*

Can I take the French text as adopted? *(Agreed.)*

— *Summary 1, modified in this way was adopted.*

**The President.** — We now come to the new text of *Summary 2*.

**Mr. Uytborck** read this Summary as follows :

« 2. In order to avoid severe shocks to the track due to higher speeds, there is a tendency to use on electric locomotives devices allowing transverse movement either between the body and the bogie, similar to those already used on other types of stock, or even between the axle and the bogie.

« On locomotives connecting devices between bogies are tending to become general in certain countries :

« *a)* in order to reduce side wear on the track and flange wear, especially on curves;

« *b)* in order to reduce hunting on straight track. »

**The President.** — Do you agree to this text? *(Agreed.)*

— *Summary 2, modified in this way, was adopted.*

**The President.** — Gentlemen, this brings us to the end of our aggenda. I am sure we should all like to express our thanks to the Reporters and the Special Reporter, Mr. Hoffet, and to all those who took part in the discussions. I am afraid I gave some delegates additional work in trying to reach an agreement outside the meetings of the Section but perhaps this has led in the end to a clearer and more satisfactory wording. I am very grateful to you all for this final agreement which we have been able to reach.

Gentlemen, as we have exhausted our aggenda, the Meeting is at an end.

# DISCUSSION AT THE PLENARY MEETING.

## Meeting held on October 4th, 1950.

DR. ENG. DI RAIMONDO, PRESIDENT, IN THE CHAIR.
GENERAL SECRETARIES : MR. P. GHILAIN AND DR. ENG. M. VALDIVIESO.
ASSISTANT GENERAL SECRETARY : MR. CH. E. WHITWORTH.

**The President** (in French). — We now come to the examination of the summaries relating to Question VI.

**Mr. Ghilain,** *General Secretary* (in French). — The text of the Summaries of Question VI was published in the *Daily Journal of the Congress*, No. 6 of the 3rd October 1950 and No. 7 of the 4th October 1950.

— *The Summaries raised no remarks.*

**The President.** — The Summaries of Question VI are therefore adopted.

### SUMMARIES.

*Introduction.*

« The construction of railway rolling « stock in general and of motor vehicles « in particular is limited by:—

« *a*) the loading gauge;

« *b*) the permissible axle load;

« *c*) the materials available;

« *d*) the cost of construction;

« *e*) the cost of maintenance, inspec- « tion and repair;

« *f*) the maximum speed;

« *g*) the tractive effort.

« 1. *a*) There are a number of dif- « ferent transmission systems which can « be used for all speeds up to about « 150 km. per hour and for horse- « powers up to 1 500 per motored axle.

« *b*) Nose suspension inevitably « causes vertical and lateral shocks to « the track by reason of the unsprung « weight of the motor. The progressive « wear on rail and flange only aggravates « the trouble. It is desirable to under- « take trials for measuring the efforts « exerted on the track by different sys- « tems of suspension of the motors.

« *c*) Choice between the different sys- « tems of transmissions will be dictated « by local conditions :

« if the track is sufficiently robust and « well maintained, nose suspension may « be used without great disadvantage;

« if the track is weaker, it is desirable « to use one of the systems employing « resilient transmission and frame « mounted motors if possible.

« 2. In order to avoid severe shocks « to the track due to higher speeds, there « is a tendency to use on electric loco-

« motives devices allowing transverse « movement either between the body « and the bogie, similar to those already « used on other types of stock, or even « between the axle and the bogie.

« On locomotives connecting devices « between bogies are tending to become « general in certain countries :

« *a*) in order to reduce side wear on « the track and flange wear, especially « on curves;

« *b*) in order to reduce hunting on « straight track.

« 3. The operating conditions with « steam and electric traction differ too « much from one another to permit a « reasonable comparison of track main- « tenance costs to be made.

# CORRIGENDUM

**Bulletin of October 1950.**

**Special report by** Mr. G. Chan **on Question V (Rome Congress 1950).**

At the request of Mr. E. Pugson of the British Railways, Reporter of the same question, we publish the following modification to the paragraph below relating to « *Solid wheels* ».

The above special report *on page 2059/53, 2nd. col.* (*right*) mentions :

The London Transport Executive after 30 years experience report there is practically no difference between the total cost of the two types and that it has adopted the one piece wheel for all carrying axles.

This paragraph must be deleted and replaced by the following :

« *According to the London Transport Executive, results obtained are satisfactory on non-motored axles only.*

« *Experience with solid wheels on motored axles shows that the rate of wear is too rapid to make them an economical proposition for this duty on our service.*

« *Providing the wheels are rolled from steel of a specification that will give satisfactory wear, there is little to choose between the costs over a period of 30 years between tyred and solid wheels for non-motored axles.* »

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*PUBLISHED UNDER THE SUPERVISION OF*

**P. GHILAIN,**

**General Secretary of the Permanent Commission of the International Railway Congress Association.**

**(JUNE 1951)**

16. 385. (02 ]

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KINSON (A. D. S.).
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**Les diagrammes thermodynamiques.**
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Les **nouvelles automotrices légères** des Chemins de fer suédois. (1 000 mots & fig.)

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## Rail et Traction. (Bruxelles.)

**1949** **621** .335 (493)
Rail et Traction, 1er août, p. 5.
La **nouvelle locomotive électrique B-B** de la S. N. C. B. (1 500 mots & fig.)

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## Revue de l'Aluminium. (Paris.)

**1950** **621** .336
Revue de l'Aluminium, septembre, p. 308.
ALBERT (L.). — A propos des **fils de contact en aluminium-acier pour tramways et trolleybus.** (2 000 mots & fig.).

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**1950** **669**
Revue de l'Aluminium, octobre, p. 385.
PENEL (P.). — Le **traitement thermique des alliages légers.** Trempe et revenu. (3 500 mots & fig.)

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**1950** **656** .213 (42) & **669** .71 (42)
Revue de l'Aluminium, novembre, p. 421.
Les **passerelles télescopiques de la gare maritime** de Southampton. (1 500 mots & fig.)

**1950** **656** .225 & **656** .261
Revue de l'Aluminium, novembre, p. 425.
Le « **Banabox** », **container pliant pour le transport des bananes.** (600 mots & fig.)

**1951** **624** .6 (42) & **669** .71 (42)
Revue de l'Aluminium, février, p. 56.
VICTOR (M.). — Un **pont en duralumin de 95 m de portée** sur la rivière Tummel. (1 000 mots & fig.)

## Revue Générale des Chemins de fer. (Paris.)

**1950** **621** .33 (44)
Revue générale des Chemins de fer, novembre, p. 495.
VAUBOURDOLLE & WALTER. — L'**équipement électrique à 20 000 volts, 50 Hertz** de la ligne d'Aix-les-Bains à la Roche-sur-Foron. (15 000 mots & fig.)

**1950** **656** .225 (44) & **656** .24 (44)
Revue générale des Chemins de fer, novembre, p. 527.
HASENKNOPF & DEHEINZELIN. — La **prévention des avaries** à la S. N. C. F. L'utilisation de « matelas anti-chocs ». (2 000 mots & fig.)

**1950** **621** .33 (44)
Revue générale des Chemins de fer, novembre, p. 532.
**Premiers essais de traction électrique à courant monophasé à fréquence industrielle** sur la ligne Aix-les-Bains-Annecy. (800 mots & fig.)

**1950** **385** (06 .112
Revue générale des Chemins de fer, décembre, p. 543.
La **XV^e Session** de l'Association Internationale du Congrès des Chemins de fer (Rome, 1950). (8 000 mots & fig.)

**1950** **621** .332
Revue générale des Chemins de fer, décembre, p. 553.
CHAPPÉE. — Le **transport à grande distance de l'énergie électrique.** (14 000 mots & fig.)

**1950** **621** .392 (44) & **621** .136 (44)
Revue générale des Chemins de fer, décembre, p. 569.
PELLEVAT. — L'évolution de la **construction des tenders soudés.** (7 000 mots & fig.)

**1951** **621** .431 .72 (44)
Revue générale des Chemins de fer, janvier, p. 3.
TOURNEUR. — Les **locomotives Diesel-mécaniques prototypes 030-DC-1 et 2** de la S. N. C. F. (3 500 mots & fig.)

**1951** **385** .62 & **385** .63
Revue générale des Chemins de fer, janvier, p. 10.
DURAND (P.). — La révision des **Conventions internationales concernant le transport des voyageurs, bagages et marchandises** (Berne, mai 1950). (3 000 mots.)

**1951** **625** .13
Revue générale des Chemins de fer, janvier, p. 14.
PHILIBERT & BATSALLE. — Le **nouveau pont** dit « de l'Ecole vétérinaire » en gare de Toulouse-Matabiau. (5 000 mots & fig.)

**1951** **656** .24 (44
Revue générale des Chemins de fer, janvier, p. 25.
BROC. — La **prévention des avaries** à la S. N. C. F
**Dispositif amortisseur de chocs pour le transport de marchandises fragiles.** (4 000 mots & fig.)

**1951** **656** .254 (44
Revue générale des Chemins de fer, janvier, p. 31.
SPIRE. — Le **poste de régulation** de « Pont Cardinet »
(3 000 mots & fig.)

**1951** **621** .33 (4 + 6
Revue générale des Chemins de fer, janvier, p. 44.
Les **lignes électrifiées** des Chemins de fer d'Europe et d'Afrique du Nord. (Tableau et carte.)

## Science et Technique. (Bruxelles.)

**1949-1950** **625** .1 (493
Science et Technique, n° 6-7, p. 115; n° 8-9, p. 179; n° 11 12, p. 245; n° 4, p. 81.
DE LE COURT (F.). — La **Jonction Nord-Midi.** Son caractère hydraulique et le problème des égouts. (8 000 mots & fig.)

**1949** **621** .33 (44
Science et Technique, n° 6-7, p. 125.
LAMALLE (U.). — **Orientation nouvelle de l'électrification des Chemins de fer français** par l'utilisation directe du courant alternatif industriel à 50 périodes par seconde. (1 800 mots.)

**1949** **621** .33 (493
Science et Technique, n° 11-12, p. 227.
LAMALLE (U.). — **L'inauguration du service électrique** sur la ligne Bruxelles-Midi à Charleroi. (3 000 mots tableau & fig.)

**1950** **624** .2 & **69**
Science et Technique, n° 3, p. 43; n° 4, p. 71.
MAGNEL (G.). — **Essai jusqu'à rupture d'une poutre continue en béton précontraint.** (4 000 mots & fig.)

**1950** **621** .132 .5 (44
Science et Technique, n° 6-7, p. 127; n° 8-9, p. 179.
LAMALLE (U.) — **La locomotive expérimentale à marchandises de la S. N. C. F.** Type 1-6-0 à 6 cylindres compound, à surchauffe, resurchauffe, enveloppes de vapeur et distribution par soupapes. (2 500 mots & fig.

**1950-1951** **385** (06 .11
Science et Technique, n° 11-12, p. 235; n° 1-2, p. 1
LAMALLE (U.). — Le **Congrès international des Chemins de fer. XV^e Session — Rome 1950.** (6 000 mot & fig.)

## Travaux. (Paris.)

**1950** **656** .211 .7 (44
Travaux, juin, p. 342.
CHEVRIER (C.). — La reconstruction du quai d'accostage des **ferry-boats** au port de Dunkerque (7 000 mots & fig.)

**1950** 656 .213 (44)
Travaux, juin, p. 467.
VASSEUR (J.). — La **reconstitution de l'outillage du port du Havre.** Engins de radoub. Hangars et terre-pleins. **Gares maritimes.** Engins de manutention. (7 000 mots & fig.)

**1950** 62 (01 & 691
Travaux, octobre, p. 696.
MOUGENOT (E.). — Abaque universel pour la **détermination des armatures dans les pièces fléchies.** (5 000 mots & fig.)

**1950** 691 (44)
Travaux, octobre, p. 721.
Commission d'études techniques de la Chambre syndicale des Constructeurs en **ciment armé** de France. (8 000 mots.)

**1950** 62 (01 & 691
Travaux, décembre, p. 776.
**Association scientifique de la précontrainte.** Journées internationales, 1950. (6 000 mots.)

**1950-1951** 624 .2
Travaux, décembre, p. 787; février, p. 265.
MALLET (Ch.). — **Notes sur la formule de BRESSE.** (10 000 mots & fig.)

## In German.

### Glasers Annalen. (Berlin.)

**1950** 621 .13 (43)
Glasers Annalen, Oktober, S. 179.
WITTE (F.). — **25 Jahre Dampflokomotiven.** Reichsbahn-Bundesbahn. (2 500 Wörter & Abb.)

**1950** 656 .28 (43)
Glasers Annalen, Oktober, S. 187.
SCHULZE-MANITIUS (H.). — **Unfälle im Eisenbahnbetrieb.** (2 000 Wörter & Abb.)

**1950** 621 .135 .5
Glasers Annalen, November, S. 197; Dezember, S. 222.
EWALD (K.). — Die **selbstwirkende Gegendruckbremse.** (5 000 Wörter & Abb.)

**1950** 621 .138 .3 (43)
Glasers Annalen, November, S. 202.
RADDE (R.). — Die **chemische Lokomotivreinigungsanlage** im Bahnbetriebswerk Seddin. (3 000 Wörter & Abb.)

**1950** 621 .135 .2
Glasers Annalen, November, S. 206.
LÖW (H.). — **Über das Bereifen von Lokomotivradsätzen.** (2 500 Wörter & Abb.)

**1950** 725 .33
Glasers Annalen, Dezember, S. 217.
HEIN (W.). — **Der Wasserschlag in Betriebswasserleitungen.** (2 000 Wörter & Abb.)

### Schweizerisches Archiv für Verkehrswissenschaft und Verkehrspolitik. (Zürich.)

**1950** 385 (09 (492)
Schweizerisches Archiv für Verkehrswissenschaft u. Verkehrspolitik, Nr 3, S. 201.
SCHWABE (H.). — Die **Niederländischen Eisenbahnen.** (17 000 Wörter, Tabellen & Karte.)

**1950** 385 .15 (494)
Schweizerisches Archiv für Verkehrswissenschaft u. Verkehrspolitik, Nr 3, p. 241.
Dr BORN (H.). — Die Problematik weiterer **Privatbahnverstaatlichungen.** (7 000 Wörter.)

**1950** 385 .52
Schweizerisches Archiv für Verkehrswissenschaft u. Verkehrspolitik, Nr 3, S. 265.
BRATSCHI (R.). — **Das Realeinkommen der Bahnarbeiter** in verschiedenen Ländern. (2 000 Wörter.)

**1950** 385 .15 (494)
Schweizerisches Archiv für Verkehrswissenschaft u. Verkehrspolitik, Nr 4, S. 301.
Dr MEILE (W.). — **Kriterien zur Verstaatlichung von Privatbahnen** in der Schweiz. (22 000 Wörter & Tabellen.)

**1950** 656 .1 (494)
Schweizerisches Archiv für Verkehrswissenschaft u. Verkehrspolitik, Nr 4, S. 356.
RUCKLI (R.). — Der **Einfluss der Verkehrslasten auf die Strassenkosten.** (6 000 Wörter & Abb.)
MEYER (H. R.). — Replik. (2 000 Wörter.)

## In English.

### American Railway Engineering Association. (Chicago.)

**1950** 385 (061 .4 (73)
Bulletin, American Railway Engineering Association, No. 488, June-July.
**Reports of Committees :** Tests of steel girders on the Chicago & North Western Ry; Ties; Lateral forces exerted by locomotives on curved track. (109 pages, illustrated).

**1950** 385 (061 .4 (73)
Bulletin, American Railway Engineering Association, No. 490, November.
**Reports of Committees.** Highways; Water service and sanitation; Yards and terminals; Uniform general contract forms. (80 pages, illustrated.)

**1950** 385 (061 .4 (73)
Bulletin, American Railway Engineering Association, No. 491, December.
**Reports of Committees.** Buildings; Impact and bridge stresses; Waterproofing; Ties; Wood preservation; Economics of railway labor; Maintenance.

## The Engineer. (London.)

**1950** **621** .33 (44)
The Engineer, August 18, p. 188.
**Power supply for Paris-Lyons electrification.** (1 800 words & fig.)

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**1950** **656** .212 .5 (71)
The Engineer, September 15, p. 275.
LIVESAY (E.). — **The St. Luc marshalling yard, Montreal, C. P. R.** (1 800 words & fig.)

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**1950** **656** .222 .1 (94)
The Engineer, September 22, p. 282.
PAULIN (G. H.). — **Transcontinental Railway Australia.** (3 000 words & fig.)

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**1950** **621** .33 (42)
The Engineer, October 13, p. 367.
**Railway overhead line inspection vehicle.** (1 200 words & fig.)

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**1950** **621** .131 .3 (42)
The Engineer, October, 13, p. 377.
NOCK (O. S.). — **The L. M. S. mobile test plant in action.** (3 000 words & fig.)

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**1950** **656** .254 (42)
The Engineer, November 17, p. 461.
**A Southern Region colour-light signalling scheme.** (2 000 words & fig.)

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**1950** **621** .431 .72 (42)
The Engineer, November 24, p. 490.
**A mixed traffic Diesel-electric locomotive No. 10800.** (3 800 words & fig.)

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**1950** **385** (09 (42)
The Engineer, December 1, p. 539.
RIDDLES (R. A.). — **Nationalisation and the Railway Mechanical Engineer.** (2 000 words.)

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**1950** **621** .431 .72 (62)
The Engineer, December 15, p. 592.
**Diesel-electric trains for Egypt.** (1 600 words & fig.)

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**1950** **656** .212 .6 (42)
The Engineer, December 15, p. 597.
**A locomotive unloading gantry.** (2 400 words & fig.)

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**1950** **625** .23
The Engineer, December 15, p. 601.
**Results of double-deck train trials.** (500 words.)

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## Engineering. (London.)

**1950** **656** .212 .5 (7)
Engineering, December 29, p. 553.
**The St. Luc marshalling yard** of the Canadian Pacific Railway. (4 000 words & fig.)

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**1951** **621** .436 (42)
Engineering, January 12, p. 41.
Gearbox for **500 HP Diesel locomotive.** (500 words & fig.)

**1951** **656** .281 (4
Engineering, January 12, p. 40.
**Derailment of a train** due to buckled track. (1 2
words.)

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**1951** **625** .2 (4
Engineering, January 19, p. 87; January 26, p. 113.
SMITH (S. G.). — Standardisation of new **coachi**
**stock** on British Railways. (3 600 words.)

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**1951** **621** .132 .1 (4
Engineering, February 2, p. 126.
**Standard 4-6-2 mixed traffic locomotive, British Ra**
**ways.** (2 000 words & fig.)

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## Modern Transport. (London.)

**1950** **385** (09 (42) & **656** .2 (4
Modern Transport, November 25, p. 3; December
p. 24; December 9, p. 5.
RIDDLES (R. A.). — **Unification of British Railwa**
(3). (6 800 words & tables.)

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**1950** **385** (09 (42) & **656** .2 (
Modern Transport, December 16, p. 11; December
p. 9.
WATSON (D. G.). — **Unification of British Railwa**
(4). (4 000 words & diagr.)

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**1950-51** **385** (09 (42) & **656** .2 (
Modern Transport, December 30, p. 5; January 6, p.
January 13, p. 13; January 20, p. 7; January
p. 13; February 3, p. 7; February 9, p. 15.
**Unification of British Railways.**
ALLEN (W. P.). — No. 5. Looking after 625
employees. (1 600 words.)
BLEE (David). — No. 6. A review of commerc
principles. (6 600 words.)

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**1951** **625** .4 (4
Modern Transport, February 13, p. 3.
**Services between the London Termini.** (1 200 wo
& fig.)

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**1951** **621** .132 .6
Modern Transport, February 20, p. 10.
**Tank locomotives** for Tanganyika. (6 000 words & fi

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**1951** **621** .132 .3 (4
Modern Transport, February 27, p. 7; March 17, p.
March 31, p. 10.
POULTNEY (E. C.). — Modern **high powered lo**
**motives.** (3 500 words & fig.)

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**1951** **625** .23 (4
Modern Transport, February 27, p. 9.
SMITH (S. G.). — **Standardisation of coaching sto**
(1 500 words.)

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**1951** **621** .132 .1 (
Modern Transport, February 3, p. 3.
**First British Railways standard locomotive.** (2
words & fig.)

**1951** **656** .222 .5 (42)
Modern Transport, February 10, p. 3.
**A coach operator's chart room.** (600 words & fig.)

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**1951** **621** .132 .1 (42)
Modern Transport, February 10, p. 5.
**The first standard locomotive.** (1 200 words & fig.)

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**1951** **621** .431 .72 (42)
Modern Transport, February 17, p. 3; February 24, p. 7.
**A new Diesel-electric locomotive.** (2 300 words & fig.)

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**1951** **625** .24 (42)
Modern Transport, February 24, p. 5; March 3, p. 7.
PARKHOUSE (S. E.). — **British Railways wagons** . & II. (2 500 words.)

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## The Oil Engine and Gas Turbine. (London.)

**1951** **621** .431 .72 (42)
The Oil Engine and Gas Turbine, February, p. 296.
**1750 B.H.P. Diesel-electric locos for B.R.** (700 words & fig.)

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**1951** **621** .431 .72 (42)
The Oil Engine and Gas Turbine, February, p. 298.
**Service results with double crankshaft engines.** (600 words & fig.)

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**1951** **621** .431 .72 (5)
The Oil Engine and Gas Turbine, March, p. 347.
**New passenger locomotive for Siam.** (600 words & fig.)

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**1951** **625** .172 (42)
The Oil Engine and Gas Turbine, March, p. 360.
**Railway track tamping.** (500 words & fig.)

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## Proceedings, The Institution of Mechanical Engineers. (London.)

**1951** **621** .438 (42)
Proceedings, the Institution of Mechanical Engineers, Vol. 163 (W. E. P. No. 60).
HAYNE CONSTANT. — The **gas turbine** in perspective. (4 200 words & fig.)

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## Railway Age. (New York.)

**1950** **621** .431 .72 & **625** .14
Railway Age, July 29, p. 30.
HIGGINS (E. M.). — **Grease lubrication of roller bearings.** (2 000 words & fig.)

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**1950** **621** .33 (73)
Railway Age, August 5, p. 47.
**Air-conditioned M. U. cars for commuter trains.** (1 200 words & fig.)

**1950** **625** .232 (73)
Railway Age, August 19, p. 28.
**Southern Pacific places « Cascade » stream liner in service.** (1 100 words & fig.)

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**1950** **625** .232 (73)
Railway Age, August 26, p. 28.
**New « Sunset Limiteds » on Southern Pacific.** (5 000 words & fig.)

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**1950** **621** .431 .72 (73)
Railway Age, September 9, p. 47.
**A three-in-one type of wheel protection tried on Diesel locomotives.** (2 000 words & fig.)

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**1950** **621** .431 .72 (73) & **625** .28 (73)
Railway Age, September 20, p. 21.
HESKETT (J. Z.). — **Tonnage ratings for Diesel power.** (6 000 words & fig.)

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**1950** **625** .617 (73)
Railway Age, September 30, p. 28.
WILLETS (E. H.). — **The contrailer.** (800 words & fig.)

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**1950** **625** .232 (73)
Railway Age, October 21, p. 20.
**Burlington buys gallery suburban cars.** (2 200 words & fig.)

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**1950** **656** .21 (73)
Railway Age, November 4, p. 56
McCARTY (C. E.). — **Retarders and intensified supervision cut switching damage to equipment and lading.** (400 words, tables & fig.)

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**1950** **621** .431 .72 (73)
Railway Age, November 18, p. 51.
DELANEY (J. P.) and GAUSS (J. H.). — Versatility stressed in **Alco-G. E. dual-purpose road locomotive.** (1 000 words & fig.)

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**1950** **621** .132 (73)
Railway Age, November 25, p. 23; December 2, p. 64.
**Improving steam locomotive performance.** (7 000 words, tables & fig.)

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**1950** **624** .3 (73)
Railway Age, December 9, p. 36.
**Huey long bridge gets aluminum deck.** (3 000 words & fig.)

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**1950** **624** .52 (73)
Railway Age, December 23, p. 16.
**New high bridge over Cumberland River.** (1 800 words & fig.)

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**1950** **625** .244 (73)
Railway Age, December 23, p. 27.
**Mechanical refrigeration of cars.** (1 000 words & fig.)

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**1950** **621** .431 .72 (73)
Railway Age, December 30, p. 32.
The place of **multiple unit Diesel cars.** (2 000 words & fig.)

## Railway Gazette. (London.)

**1950** **625** .255
Railway Gazette, April 21, p. 450.
**Electro-pneumatic brakes.** (1 500 words & fig.)

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**1950** **625** .14
Railway Gazette, April 21, p. 452.
**The effect of electric traction on the track.** (1 600 words & fig.)

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**1950** **385** (09 (49)
Railway Gazette, April 21, p. 453; April 28, p. 479.
MISSENDEN (E.). — **The first two years of British Railways.** (5 200 words.)

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**1950** **656** .283 (42)
Railway Gazette, April 21, p. 462.
**Ministry of Transport Accident report.** (1 600 words & fig.)

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**1950** **313** .385 (42)
Railway Gazette, April 21, p. 466.
**British Transport Commission statistics (Period No. 2).** (Tables.)

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**1950** **624** .7 (44)
Railway Gazette, April 28, p. 482.
**Welded bridges in Northern France.** (1 000 words & fig.)

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**1950** **621** .136 .3 (42)
Railway Gazette, May 5, p. 516.
**Renewal of Wiske Moor Water troughs.** (1 000 words & fig.)

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**1950** **621** .135 .2
Railway Gazette, May 5, p. 539.
CLEAR HARRISON (F.). — **Novel axleboxes for express locomotives.** (1 000 words & fig.)

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**1950** **621** .138 .5 (42)
Railway Gazette, May 12, p. 540.
**Locomotive repairs at Swindon Works, Western Region.** (1 700 words & fig.)

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**1950** **621** .355 (469)
Railway Gazette, May 19, p. 569.
**Electric rolling stock for Estoril Railway, Portugal.** (2 600 words & fig.)

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**1950** **385** (09 (52)
Railway Gazette, May 26, p. 600.
**Impressions of the Japanese Railways.** (1 200 words & fig.)

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**1950** **313** .385 (42)
Railway Gazette, May 26, p. 605.
**British Transport Commission Statistics.** (Tables.)

## In Spanish.

## Boletin de la Asociación permanente del Congreso Panamericano de Ferrocarriles (Buenos Aires.)

**1950** **385** (061 (7 +
Boletin de la Asoc. perman. del Congreso Panamer de Ferrocarriles, septiembre-diciembre, p. 17.
**VII Congreso Panamericano de Ferrocarriles. I Asamblea de México.** (74 páginas.)

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**1950** **385** (061 (7 +
Boletin de la Asoc. perman. del Congreso Panameri de Ferrocarriles, septiembre-diciembre, p. 91.
**VII Congreso Panamericano de Ferrocarriles,** Méxic 10 de Octubre de 1950. **Informe de la Comisión Perm nente** presentado por el Presidente de la Asociaci del Congreso Panamericano de Ferrocarriles, Ingeni Pedro P. MARTIN, 1948-1950. (54 páginas.)

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## Revista de Ciencia aplicada. (Madrid.)

**1950** **62** (01 & 6
Revista de Ciencia aplicada, julio-agosto, p. 333.
MARGARIT (A.). — Nuevo método para la mec ción de **módulos de elasticidad** y posibilidad de su aplic ción a los **hormigones.** (5 000 palabras & fig.)

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## Revista del Colegio de Ingenieros de Venezuel (Caracas.)

**1950** **625** .142 .2 (8
Revista del Colegio de Ing. de Venezuela, nº 171, p. 7.
**Cálculos de los durmientes de madera en los puent** del Ferrocarril Central de Venezuela. (1 500 palabr & fig.)

## In Italian.

## Giornale del Genio Civile. (Roma.)

**1950** **624** .
Giornale del Genio Civile, luglio-agosto, p. 442.
FUXA (U.). — Sul calcolo dei traversi e sulla lo influenza nella distribuzione dei carichi concentr fra le travi longitudinali dei **ponti in cemento armat** (4 000 parole & fig.)

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**1950** **62** (
Giornale del Genio Civile, settembre, p. 529.
MERLINO (F. S.). — Un nuevo tipo di **estensimet ottico.** (1 500 parole & fig.)

**1950** **624** .2
ornale del Genio Civile, ottobre, p. 576.
GOSSI (A.). — Sul **calcolo della trave a sezione** **iabile sollecitata a pressione e flessione.** (5 000 parole, elle & fig.)

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**1950** **624** .63 (45)
ornale del Genio Civile, novembre, p. 639.
RINALDI (G.). — **Ricostruzione del ponte in cemento** **nato precompresso** sulla Savanella-Accursi per la da della Romagna in comune di Molinella. (1 600 ole & fig.)

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**1950** **62** (01
ornale del Genio Civile, novembre, p. 666.
GUERRA (G.). — Le **applicazioni della fotoelasticità** **ingegneria civile.** (3 000 parole & fig.)

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## Rivista di Ingegneria. (Milano.)

**1951** **62** (01
ista di Ingegneria, gennaio, p. 3.
ETROZZI (E.). — Di una applicazione dei **tensio-** **ri a variazione di resistenza.** (3 000 parole & fig.)

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**1951** **656** .221
ista di Ingegneria, febbraio, p. 113.
GABRIELLI (G.). & VON KÁRMÁN (Th.). — **enza specifica necessaria per la propulsione dei veicoli.** 000 parole & fig.)

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**1951** **625** .42 (45)
ista di Ingegneria, marzo, p. 233.
EMENZA (M.). — La **metropolitana di Milano.** **cetti tecnici ed economici.** (10 000 parole, tavole & fig.)

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## Trasporti pubblici. (Roma.)

**1950** **625** .2 : **625** .62 (45)
sporti pubblici, aprile, p. 385.
IBONA (E.). — **Trasformazione di vecchie vetture** **nviarie in moderne vetture** ad assi guidati. (1 100 ole & fig.)

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**1950** **621** .33 (45)
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M. Weissenbruch & Co., Ltd., Printer to the King, 49, rue du Poinçon, Bruxelles.

M. WEISSENBRUCH & Co. Ltd.
Printer to the King
(Manag. Dir.: P. de Weissenbruch,
238, chaussée de Vleurgat, XL)

PRINTED IN BELGIUM

Edit. responsible : P. Ghilain